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ABSTRACT

The first International Symposium on Library and Information Science Education in the Digital Age, held in November 2000 at Wuhan University (Wuhan, China), drew more than 90 library and information science professionals from China, Macao, and the United States. Participants gathered to discuss a question of common concern: How are our respective library school preparing students for careers in library and information science and management? This report contains papers presented at the symposium's plenary sessions. These papers, written by leading Chinese and American educators, provide a snapshot of the educators' concerns at a time when the digital environment is bringing about rapid, fundamental change in libraries. The papers included in this report are: "Embedding an LIS School within the University and Society" (Leigh Estabrook); "Information Science Facing the 21st Century" (Liang Zhanping); "The Role of the Dean in Implementing Change" (Brooke E. Sheldon); "Again on the Development of Our Discipline: Suggesting 'Information Resources Management' Be Our First-Level Discipline" (summary) (Meng Guangjun); "The Reformation and Innovation of Library Science Education in the Digital Age" (Peng Feizhang); "Library and Information Science Education in China Today" (Wu Weici); "The Transformation of Academic Libraries in the Twenty-first Century: Challenges and Opportunities for Library and Information Science Education" (Rush G. Miller); "On the Objective and Implementation of Library and Information Science Education in the Digital Age" (Ma Feicheng); "New Developments in Graduate Education in Library and Information Science in the United States: Formats and Technologies for Offering Distance Education Courseware" (Blanche Woolls); "Some Reflections on Library Education in China" (Peter Zhou); "A Comparative Analysis of LIS Graduate Education in China and the United States" (Chen Chuanfu); and "The Enhancement and Expansion of Information Science Graduate Degree Courses in the Digital Age" (Hu Changping). Appendixes include

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institutions represented at the conference; symposium agenda; and an Action Plan Proposal for Library and Information Science Education in China in the Twenty-first Century. (AEF)

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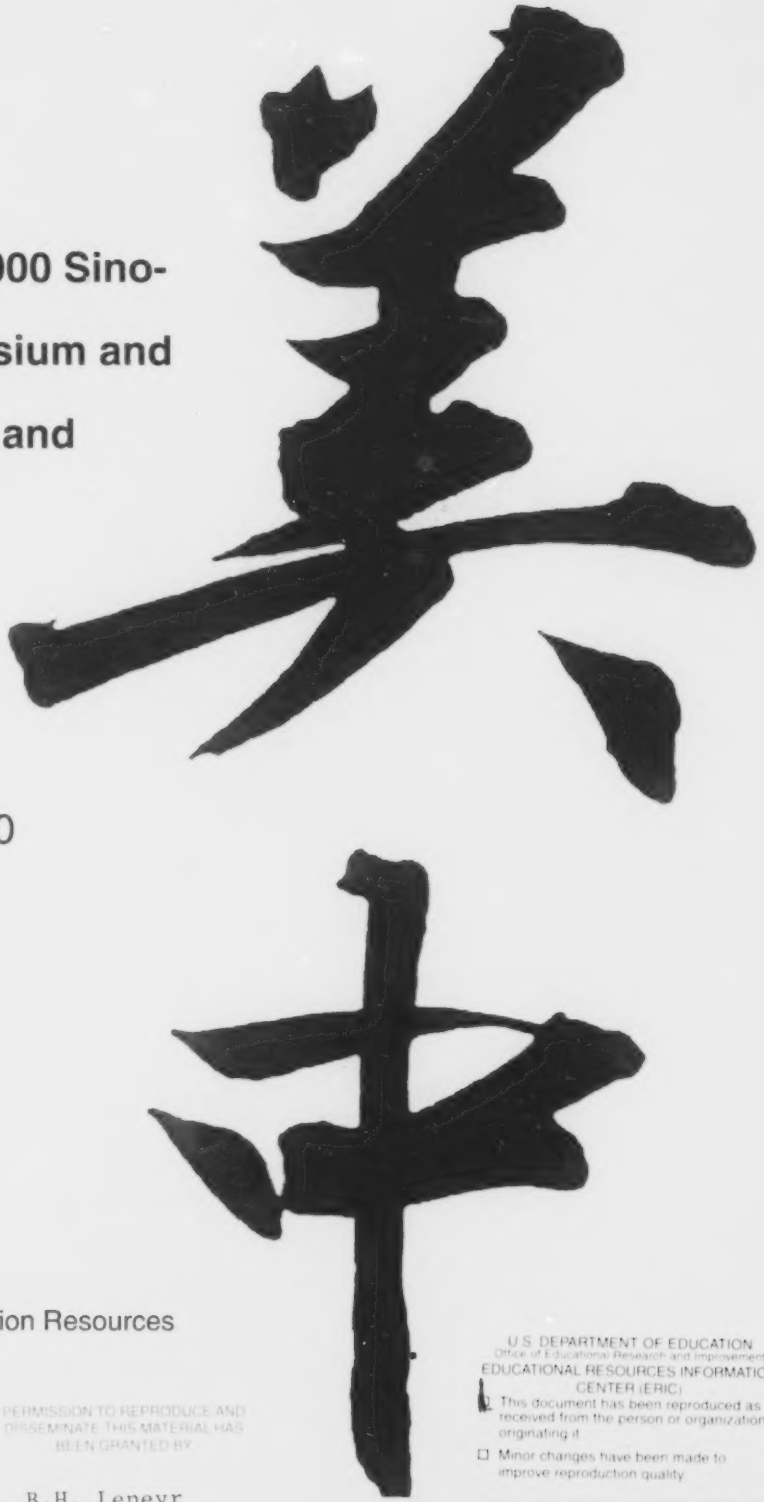

November 5-10, 2000
Wuhan, China

D. E. Perushek
Editor

Council on Library and Information Resources
Washington, D.C.

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November 5-10, 2000
Wuhan, China

D. E. Perushek
Editor

Council on Library and Information Resources
Washington, D.C.

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D. E. Perushek, assistant university librarian for collection management at Northwestern University in Evanston, Illinois, studied library science at the University of Michigan and the University of Chicago. She began her library career as head of the Wason Collection at Cornell University. Subsequently, she was curator of the Gest Oriental Library and East Asian Collection at Princeton University, then associate dean for collection services at the University of Tennessee, Knoxville. She has worked with Fudan University in Shanghai, China, on a project to microfilm books from the Sino-Japanese War period with support from the Henry Luce Foundation and the National Endowment for the Humanities. Her current research interests lie in materials budget allocation and collection assessment.

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Contents

Foreword iv

Introduction 1

Keynote Papers

Embedding an LIS School within the University and Society, by Leigh Estabrook 4

Information Science Facing the 21st Century, by Liang Zhanping 9

The Role of the Dean in Implementing Change, by Brooke E. Sheldon 14

Again on the Development of Our Discipline: Suggesting "Information Resources Management" Be Our First-level Discipline, by Meng Guangjun 17

The Reformation and Innovation of Library Science Education in the Digital Age, by Peng Feizhang 19

Library and Information Science Education in China Today, by Wu Weici 25

The Transformation of Academic Libraries in the Twenty-First Century: Challenges and Opportunities for Library and Information Science Education, by Rush G. Miller 29

On the Objective and Implementation of Library and Information Science Education in the Digital Age, by Ma Feicheng 36

New Developments in Graduate Education in Library and Information Science in the United States: Formats and Technologies for Offering Distance Education Courseware, by Blanche Woolls 42

Some Reflections on Library Education in China, by Peter Zhou 49

A Comparative Analysis of LIS Graduate Education in China and the United States, by Chen Chuanfu 53

The Enhancement and Expansion of Information Science Graduate Degree Courses in the Digital Age, by Hu Changping 66

Appendix A: Institutions Represented at the Conference 70
Appendix B: Symposium Agenda 71
Appendix C: Action Plan Proposal for Library and Information Science Education in China in the Twenty-first Century 75

Foreword

The question of how best to train professionals for library and information professions is being debated in many countries. What should these professionals be prepared to do? The very question raises a host of other questions about the future of the information infrastructure and how and where knowledge will be created, kept, and made available.

This collection of papers, written by leading Chinese and American educators, provides a snapshot of the educators' concerns at a time when the digital environment is bringing about rapid, fundamental change in libraries. As Diane Perushek notes in her introduction, there is a high degree of commonality in the concerns expressed by participants from both countries, despite the quite different paths that the library profession has followed in each.

It is our hope that by helping to distribute the proceedings from this symposium, professionals in each country will become more aware of our common challenges and visions, and that the ideas expressed in these papers might stimulate new thinking and cooperation. The Council on Library and Information Resources is grateful to the United Board on Christian Higher Education in Asia for supporting the publication of these proceedings, to Diane Perushek for serving as rapporteur and editor of this volume, to Peter Zhou, for serving as our liaison to the symposium planners, and to the institutions and individuals in China and the United States who organized, funded, and participated in the symposium.

This volume contains papers presented at the symposium's plenary sessions. Additional papers were written for, but not delivered at, the symposium. A fuller volume of proceedings, which includes both English and Chinese versions of several of the plenary presentations, as well as papers that were not presented and the text of welcoming and concluding remarks, can be found in *Proceedings, 2000 Sino-U.S. Symposium/Workshop on Library & Information Science Education in the Digital Age, November 5-10, 2000* published by Wuhan University.

Kathlin Smith
Council on Library and Information Resources

Introduction

The first International Symposium on Library and Information Science Education in the Digital Age, held November 5-10, 2000, at Wuhan University, drew more than ninety library and information science professionals from China, Macao, and the United States. Participants gathered to discuss a question of common concern: How are our respective library schools preparing students for careers in library and information science and management?

The greatest catalyst for discussion was the strong sense that library educators in China and the United States are dealing with identical issues. Many questions dealt with the acknowledgement that the information world is new and changing, so Library and Information Science (LIS) pedagogy and curricula must adapt. Another question that speakers came back to time and again was: Who is being trained in LIS programs—Information managers? Knowledge managers? Web and software designers? Librarians? Bibliographers?

More than 30 institutions were represented at the symposium (see Appendix A). In addition to library school administrators and faculty, the participants included national government officials who oversee library education programs, graduate students from Wuhan University, librarians, and scholars. Most of the participants were practicing professionals, poised for an outcome from the symposium that they could apply once they returned to their home institutions.

The symposium was organized by Peter Xinping Zhou, while he was head of the East Asian Library at the University of Pittsburgh, and Ma Feicheng, dean in the School of Mass Communication and Information Management (SMCIM) at Wuhan University. Wuhan University and the University of Pittsburgh Library System jointly sponsored the conference, with support from the United Board for Christian Higher Education in Asia, the Chinese Ministry of Education, the Management Science Department of the State Natural Science Foundation of China, and the Council on Library and Information Resources.

The choice of venue at Wuhan University carries special significance. On its site at Luojia Hill overlooking East Lake, the university is home to the oldest library school in the country, and it ranks among the best. What is now called the School of Mass Communication and Information Management at Wuhan University traces its beginnings to the Boone Library School, which was established by an American educator in 1920 to introduce the field of library science into the Chinese education system.

The history of Wuhan itself provided a fitting backdrop. An industrial city of 7.5 million situated on the mighty Yangtze River, Wuhan (a conurbation created in 1950 by the union of three neighboring cities) was named a treaty port in 1860. The flourishing contacts between Wuhan and the West for more than a century have shaped academic as well as commercial partnerships.

Symposium Structure

The symposium was organized around a series of themes, each introduced by a keynote presentation. (The agenda is provided in Appendix B.) Discussion was encouraged after each presentation, and the atmosphere was one of dedication and candor as library and information scholars from the two countries shared experiences and visions for the future. Interspersed with the formal presentations was one afternoon of four breakout sessions that addressed topics in library education. Each session was led by a facilitator and noted by a recorder who reported back to the plenary group the following day. Because it was impossible to translate during the breakout sessions, the American speakers were given a tour of pertinent units of Wuhan University that afternoon.

Perhaps unusual at an international professional meeting, student participants' questions and opinions formed an integral part of the discussions. In addition, because all out-of-town participants stayed in the campus hotel and took their meals together, there was generous opportunity for early morning and late night continuations of discussions sparked during the symposium proper.

The conference proceeded from paper presentations to the development of a plan for improving library and information science education in China. The final day of the conference was divided into two parts: a roundtable of deans participating at the conference jointly monitored by Leigh Estabrook, dean of the Graduate School of Library and Information Science at the University of Illinois, Urbana-Champaign, and Peter Zhou; and a summary speech and discussion of an action plan. The summary highlighted concerns for the student, for the professional status of librarianship, and for the future of the library profession itself.

The action plan, drafted by Peter Zhou, Chen Chuanfu, and Ma Feicheng, and presented to participants for comment and revision, clearly struck a chord for the entire assembly. Of note is the recommendation to establish a national council on library and information science education, and of a national certification system for library and information professionals. The recommendations incorporated concerns expressed by participants throughout the week about the advisability of concentrating on both traditional library studies (e.g., bibliography and the study of rare books) and information technologies. The action plan also encourages cooperation and collaboration at home and abroad, and recognizes the efficacy of distance learning in a country as vast as China. It was suggested that a copy of the revised action plan, provided in Appendix C, be presented to the Chinese Ministry of Education.

Papers Presented by Chinese and American Educators, Administrators, and Librarians

The symposium offered a rich selection of papers focusing on how best to prepare students for the future as well as change the existing curriculum and retrain faculty to teach the wide scope of topics that library and information science encompass today. By the close of the last session, the symposium secretariat had reproduced more than 30 papers, some presented, others not read at the symposium, and distributed them to all participants. Most of the Chinese papers were not available in English, though all the American papers had been translated into Chinese prior to the symposium.

The paper by Wuhan University SMCIM Dean Ma Feicheng is worthy of special note. Ma interweaves his masterful analysis of opportunities presented to LIS schools by the networked environment with a design for a curriculum responsive to those opportunities. He proposes four "orientations" that will provide the underpinning for the new curriculum: knowledge orientation, capability orientation, market orientation, and future orientation. Furthermore, the curriculum should be infused by four principles: wholeness (an integrated set of courses that may require a total redesign, rather than just adding or deleting courses), systemic design (a predetermined set of scientific design procedures), development (continual change and revision of the curriculum), and benefits to students.

Chen Chuanfu, assistant dean at the Wuhan School of Communication and Information Management, and Peter Zhou offered papers with a distinctly international point of view. Each author has spent considerable time in both China and the United States, leading each of them to conclude that LIS schools must evolve into an amalgam of traditional courses and highly technological courses.

The presenation that elicited the most difference of opinion was one only tangentially addressing library education. This was the presentation entitled "Influences of the Digital Library on the Needs of Library Science Specialists," presented by Sun Beixin on the Digital Library at the National Library of China (NLC). Since 1995, the NLC has launched seven projects approved by the Ministry of Culture to digitize segments of the NLC collection. Participants at the symposium questioned the NLC's policy of charging fees to digitize the materials of other libraries. Participants also raised issues revolving around the support of such large projects when a relatively small number of people use the Internet in China at present (about 1 million). Others suggested alternative organizations to undertake digitization projects, for example, LIS schools. Ms. Sun, who is associate director of the National Library of China, invited other libraries to participate in the experimental programs the NLC has organized, as they digitize their bibliographic records and print collections and develop standards and application systems.

The American presentations stimulated considerable discussion, with the remarks by Brooke Sheldon, of the University of Arizona, eliciting an especially lively exchange. Drawing on her experience of 19 years as a library school dean, she spoke about three issues of common importance to American and Chinese LIS administrators. Her remarks inspired a range of questions from the audience, including "How does one handle public relations? How does one do fundraising? How does the University of Arizona attract students and faculty? How would you rank the order of a dean's priorities?

The content of Blanche Woolls' thoughtful and informative presentation on distance education was perhaps the newest to the audience. Although distance education has been popular in China for years, it has been TV-based. Her discussion of the challenges and lessons of creating distance education courseware for the Internet was met with considerable interest, given China's ambition to expand computer-based learning.

Two Cultures United by a Common Purpose

In the discussions of professional concerns, it was the commonalities, not the dissimilar elements, that were most strik-

ing. Participants shared concerns, for example, about adjusting to the commercialization of education and about the need for LIS faculty to continue learning to keep the curriculum lively and current. Issues of professionalism cropped up throughout the conference, particularly in light of LIS graduates' propensity to accept jobs with software designers, Web developers, and information management companies rather than with libraries.

Differences in the two countries, however, became points of discussion. Whereas U.S. LIS programs are training librarians for a society where 50 million Americans log on to the Internet daily, usage of the Internet in China is less pervasive, so it does not yet play as large a role in Chinese LIS education. LIS programs in China often contain a significant communications component that is more akin to U.S. schools of journalism. In the United States, faculty in LIS schools usually hold a Ph.D., with adjunct faculty coming from the ranks of librarians and other practitioners whose final degree may be at the master's level. In China, where Ph.D. programs in LIS are few, most faculty do not hold a Ph.D. Teaching in the United States tends to be problem-based, while it is text-based in China, with all schools using the same standardized textbooks. Distance learning programs in American LIS schools have become quite common, with San Jose State University's program a leader in the field. Not only are such programs absent in China, but also it will be some years before the technological infrastructure there will support such a program. Nevertheless, there was keen interest in Internet learning and the role of LIS programs in the commercialization of education. One participant predicted that by 2005 China will be home to more Internet users than any other country in the world. In a country as vast as China, there is no doubt that distance learning and online coursework hold much promise for the distribution of LIS courses throughout the length and breadth of China.

When the action plan was proposed at the end of the symposium, discussions highlighted the role of the government in LIS programs in China. Were a similar action plan to come from the American Library Association's affiliate, the Association for Library and Information Science Education (ALISE), that body might work to implement it as well as work on parts of it with ALA's Committee on Accreditation. But at the symposium, the Ministry of Education and other governmental agencies, as well as the national library association, were posited as possible recipients and ultimate adopters of the action plan.

Finally, because the Chinese system of public libraries and school libraries is only just beginning to feel some growth spurts, the education of librarians for these types of libraries was not a frequent topic of discussion. The same is true of bibliographic instruction, reference service, unmediated inter-library loan, and other public services such as patron-conducted circulation of materials, which received scant notice at the symposium though many of these topics will shape the public services of the future—at least in the United States.

Themes for Further Investigation

Certain themes reappeared constantly during the symposium, most containing what became the symposium's buzzwords—change, redesign, and reform. While some represented objects of concern, such as the commercialization of information science, others were clear wishes for the future. Following are the most frequently voiced themes during discussion and breakout sessions.

- The most important element in LIS schools is who is hired and how are they retained.
- Distance education has already changed or will change the face of LIS education.
- Definitions of the virtual library and its relation to the physical entity of the traditional library are not yet fixed.
- A tension has been created by the coexistence of the need to continue library science and archives education, and the need to establish reputable programs in information science and information management. In other words, the innate character of LIS and its intersection with related disciplines is in question.
- There is a strong desire for a fully national digitization program.
- Training students to meet society's needs in a digital world is of primary importance.
- Libraries are facing competition from the corporate world now that information has become marketable.
- Professionalism of librarians must be continued and publicized; the stature of professional librarians needs enhancing.
- The traditional library appears to be a reactive institution in the digital age.
- Focus is shifting from the library to information transfer, including the creation, acquisition, use, preservation, organization, and administration of information.

Embedding an LIS School within the University and Society

Leigh Estabrook
University of Illinois at Urbana-Champaign

Abstract: *This paper explores strategic internal changes of U.S. LIS schools during the past 15 years with examples drawn from the Graduate School of Library and Information Science at the University of Illinois. In 1985, almost all U.S. universities seemed to view their LIS schools as marginal to the university mission—a pattern consistent with the findings of Marion Paris. External developments in communication and computing technologies, with increased focus on managing the information content supported by these technologies, have changed public perceptions about the value of library and information science knowledge. Cross-disciplinary research and teaching, community outreach, and other initiatives improve LIS schools' visibility and the extent to which they are embedded in their universities. At the same time, attention to quality and promoting university recognition of quality have increased their status.*

Introduction

By the mid-1980s, library and information science (LIS) education in the United States felt itself under siege. Many of the most prestigious schools had been closed or were under review and threatened with being closed, including Case Western, the University of Chicago, and Columbia University. No school felt safe and, indeed, probably none at that time was. Our understanding of why schools of library and information science were not being supported by their universities was most clearly elucidated by Marion Paris in her dissertation, later published as a book entitled *Library School Closings: Four Case Studies* (Paris 1988). Paris's studies of four schools that were closed revealed (1) their relative isolation from the universities of which they were a part, (2) an inability of the LIS administrators to articulate the value of their programs to the universities and society, (3) a sense that the schools were encroaching on the "pedagogical territory" of other units, and (4) poor evaluations of the LIS programs by external bodies (pp. 145-153). She concluded that "[l]ibrary education programs that survive will have two attributes: imaginative, diplomatic leadership and a strong mission, or 'sense of self'" (p. 153).

This paper examines the ways in which schools of LIS education in the United States have, since the mid-1980s, sought to embed themselves into the fabric of their universities and become more fully members of the academic community. With apologies for certain parochialism, I will draw heavily from examples of changes at the University of Illinois. I do this in part because it is a situation with which I am most familiar, having been dean since January of 1986. I also do so because the strategy at Illinois has been somewhat different from other schools and also because the university is one of the major research universities in the country. The university continually evaluates its schools and departments with the result that I think often about how to make my LIS school indispensable to the institution. The number of times campus leaders comment on our school being ranked first by *U.S. News and World Report* is almost frightening, particularly when we know how fragile perceptual rankings can be.

The University of Illinois in 1985 was similar to many of its peer institutions: relatively isolated from the rest of the university and questioned by its university colleagues. Early in my deanship a former chancellor was quoted as saying about our school, "you may be a number one road apple (i.e., horse dung), but you are still a road apple." To him the peer rankings that placed our school among the top LIS schools meant little since he perceived no value in library and information science as a field. The challenge then was to change university perceptions about both the field of library and information science and about the school.

Changing perceptions of library and information science, both on our campuses and in the larger environment, has

been the easiest task for LIS faculty and administrators, although it has cost us significant effort. As information technologies, particularly the Internet and the World Wide Web, have become major forces in the economy, individuals who work with those technologies and make them more useful have gained in prestige. People like Robert Taylor, Fred Kilgour, and Forrest W. (Woody) Horton recognized by the 1970s the convergence between librarians' skills and management of new technologies. From then until the early 1990s, librarians and information scientists presciently spoke of the importance of their knowledge to computing applications and use. It was not, however, until computing technologies expanded significantly into *information* technologies, and particularly the development of the Internet and World Wide Web, that the role of librarians became widely recognized outside the field. The first National Science Foundation Digital Library Initiative provided a significant boost to our field by linking the concept of libraries to digital content. Subsequently, the growth of the Web, with its need for information architecture, information design, and content building has hastened the demand for individuals educated with the classic skills of librarians in organizing and retrieving information. One colleague recently commented, "Who would have ever thought that 'cataloging' would become a growth industry?"

The responses to social and technological change of LIS schools in the United States have varied. Syracuse University was the earliest to adopt a broader mission, becoming the School of Information Studies more than 30 years ago. A few schools, such as Pittsburgh and Drexel, also took early leadership in expanding their programs to embrace a focus on technology, expanding their offerings and degrees in areas such as telecommunications, information science, and information technology. As other schools have transformed themselves, some have focused more on users, others on aspects of communications studies or educational technology, yet others on information management in some form. In recent years, LIS schools have become increasingly different from one another as they have built on the strengths of their own faculty and those of the wider university of which they are a part. These differences reflect the unique circumstances of each institution: the relative strengths and passions of the LIS faculty and administration, the strengths and weaknesses of each university, and the financial and political position of the schools and universities. At Illinois, for example, a new budgeting system returns all graduate tuition dollars to the school, allowing significant control over our resources. This is a benefit, but also entails risks should the number of students decline. For now, our Computer Science Department and Business School have too many students, so there has been little battle for turf as we increased the number of courses in information science and technology. At the same time, the College of Communication has eagerly sought a partnership with us so that it could claim some involvement in "information technology." Our undergraduate minor in "information studies" is based in our school, but it is "in collaboration with the College of Communication"—an important symbolic and political decision.

Let us turn then to what schools have done to embed themselves in their universities. Colleges and universities in the United States assess academic programs on three essential criteria: their quality, their centrality to the mission and work of the university, and the level of demand for their program—both in recruiting students, and in placing them in jobs after graduation. (Some institutions, particularly those in which cost or revenue of LIS represents a significant portion of the college or university budget, look at a fourth criteria, cost.)

Quality

There are some differences among colleges and universities in how they measure quality. At large research universities—those that have most frequently questioned hosting LIS schools within their ivy walls—the primary indicator is the quality of faculty research. At schools based in liberal arts colleges and "second tier" universities, teaching quality may be most important (although *all* U.S. colleges and universities seem to be increasing their emphasis on faculty research).

Disciplines vary in how they do research—a historian, for example, will depend on archival records and libraries and will tend to publish in books or journals; a physicist will do experiments in a lab and depend on preprints for communication with his or her colleagues. As a multidisciplinary field, scholars in library and information science may differ in the way they conduct research and how they transmit their findings. This is often a challenge as we evaluate our colleagues within our schools or make cases for promotion and tenure in the wider universities. In the end, faculty in LIS schools must expect to be evaluated exactly as their disciplinary colleagues are in other departments: on the quality of teaching, research, and service of each faculty member.

Evaluation of faculty research will include some combination of the following:

1. Level of outside funding to support research
2. Citations by others to the scholar's work
3. Rankings of the school or department in average numbers of publications or numbers of citations
4. Awards for research received by faculty from outside bodies
5. Productivity as measured by number of publications
6. Membership in national academies or other honorary societies

For many years, LIS researchers tended to conduct their research as isolated endeavors and were driven primarily by opportunistic interests. By that I mean that LIS research often focused on problems for which there was funding or which interested the faculty member at that time. Few faculty in LIS in the 1980s and before were building a body of cumulative

research, the findings of which were significant to other scholars or built over time to a deep understanding of a problem. This has changed in important ways. One of the most important ways in which LIS schools have embedded themselves more fully in their academic institutions is by their faculty—as individuals and collectively—meeting the university expectations, as listed above. We can now find LIS scholars with a series of connected research projects and significant publication of findings that distinguish them as *experts*. We find small groups of LIS scholars who are working together to solve large problems. They identify themselves as a community and build on one another's work in deliberate ways. And they are tackling problems that are recognized by outsiders as important and worthy of significant funding. LIS schools have been recipients of large national grants. All of these factors have made a difference in the problems we can solve. They have also had an impact on how we are viewed within our universities.

At Illinois, it was important *at the university level* that our school received grants from the Institute of Museum and Library Services, Department of Commerce, Fund for the Improvement of Post-Secondary Education, and National Science Foundation programs including the Digital Library Initiative, Knowledge and Distributed Information (KDI), and Information Technology Research (ITR). The grants signify to the university that outside peer reviewers think well of the quality of the research our faculty conducts. Most of these grants involved collaboration with other departments on campus or even segments of the local community and they also funded graduate students—two other important aspects of how we are perceived by our university

The university administrators also pay attention to studies that rank the impact of the school as measured by citations to our faculty members' works and level of productivity. It has been important for me to nominate our faculty for various university and national awards because having a GSLIS faculty member at the annual Celebration of Academic Excellence or receiving one of the ALISE awards is an important goal. Obviously, we won't succeed every time—many other LIS schools are striving for the same level of excellence and recognition—but we attend to this systematically in ways few of us did 20 years ago. It has also been important to make sure GSLIS faculty receive their share of campus awards for teaching and research excellence.

I have focused on research quality but should mention also the increasing importance in many institutions of the quality of teaching and service. In public colleges and universities, student satisfaction sometimes translates into political statements. The Illinois administration conducts a survey of alumni in all departments two years after they graduate. Our senior administrators view the results of those surveys that ask, for example, how long it took the respondent to find a job, how well they feel their academic courses prepared them for their work, and whether they would choose to attend Illinois again.

For professional schools, the quality of our service is also important. At Illinois, for example, we have housed the local community computing network to which the chancellor is able to point as a symbol that the university cares for the cities of Urbana and Champaign. When the local newspaper reported that our major grant ended—one that funded bringing computing to low-income families—and the school would no longer continue the program, the head of the university was quick to find some new funding to keep the program going. The university also took notice when one of our faculty members, distinguished for founding that community computing program, was asked to stand on the platform with President Clinton when he visited our campus.

Centrality

The centrality of our units is the second important way in which universities measure their LIS schools. Marion Paris, as I noted above, identified the isolation of LIS schools as one of their greatest weaknesses, although for some time LIS schools felt they were safer if they remained isolated. I remember well the academic struggles when Rutgers initially proposed the merger between LIS and Communications.

By centrality I mean the extent to which LIS schools align themselves with university goals and priorities. It has certainly become easier for LIS schools to assert their centrality as they have made the case for their role in teaching and research related to information technology. It is not, however, the only way in which LIS schools have become more connected to other schools, colleges, and departments in their universities.

As I noted above in talking about new research initiatives, many LIS schools are significantly more interdisciplinary. In reviewing the subject of doctoral degrees of faculty we hire, I find that LIS schools have always hired a significant number of faculty with education in other disciplines; and many schools have had longstanding ties with colleges of education in educating school media specialists. The nature of our interdisciplinarity has changed however. Rather than asking all our faculty, from whatever discipline trained them, to focus on library and information science, we now encourage faculty from other disciplines to pull us outside that LIS core. Let me explain this in a different way. I believe we used to hire individuals and then funnel them into a narrower focus. We now hire individuals and depend on them to help us open our horizons and our connections to others. Our courses have become more appealing and more appropriate for students from other departments—whether it is management, computer science, mathematics, or English. At the same time, we see reasons to encourage our LIS students to incorporate knowledge from management, computer science, mathematics, English, and other disciplines into their own education and training to become information professionals. What I see is substantive interdisciplinary work. When faculty now have joint appointments with other departments, they are doing significant work in each of the dif-

ferent disciplines. Those appointments are not titular, as they once seemed to be. At the University of Illinois, one of the formal measures by which each department is evaluated is the extent to which students from LIS and other departments enroll in each other's courses.

Equally important to establishing their centrality is the leadership exerted by many LIS schools in distance education. It is not simply that many LIS schools are delivering their programs at some distance from their home institution, it is also that LIS schools in the United States are often innovators on their campuses. At the University of Illinois, for example, the provost allocated $600,000 to our school to begin the program known as LEEP3—the master's degree offered primarily through Internet technologies. We received the money because we were the first, because we were willing to begin a program quickly, and because the entire faculty was engaged in making this succeed. The program remains a model, not only on the Illinois campus, but also for the state and nation. Other Illinois programs that developed later have not received the same level of start-up funding. In other universities, we find former LIS faculty now in campus leadership positions for technology and distance education—a further indication of how our schools are perceived to have taken up a centrally important role.

LIS schools have also been responsive to renewed university concerns about undergraduate education. In the United States, as most of you know, professional LIS education is at the master's level. Being only a "professional" school was a further source of isolation from our universities. The new undergraduate programs begun by a number of our schools are not designed to prepare people to become librarians, but instead are directed to preparing individuals to work in a variety of information- and technology-intensive jobs or to use and understand information technologies in other work settings. These programs have experienced rapid enrollment increases as they fill critical university needs.

Demand

This leads me to the third factor that colleges and universities weigh in assessing programs: demand. Having many undergraduates wishing to enroll in our courses impresses our university administrators. Administrators also look at whether our graduates find jobs easily, whether our applicants are excellent students, and even the percentage of students we are able to reject. For many years at Illinois, for example, we admitted about 80 percent of the students who applied to our program and met the basic admissions criteria. For our LEEP3 program we admit fewer than one-third of the applicants—an indicator not only of demand, but of quality, too.

Measuring Success

I could summarize my comments by saying that LIS schools must be "very, very good and very, very noisy—that is, insisting that others pay attention to what they are doing."

They also must weave a spider web of connections to all other areas of the academic enterprise. To know if we are succeeding internally, we can ask several questions:

- Are we receiving an increasing proportion of our university budgets?
- Are our faculty members appointed to important university committees?
- Do other departments ask us to collaborate with them in teaching, research, or service (do they come to you as much as you go to them)?
- Are recommendations for promotion and tenure accepted easily at the campus level?
- Is your dean, director or department head asked for advice by the provost, chancellor, or other senior academic officers?
- Is your department in relatively good space or is there support from the campus to improve your facilities' centrality of space?
- Is there demand for courses from outside your program?
- Are your students and faculty receiving campus-level awards given on a competitive basis (e.g., university-wide fellowships)?
- Are your faculty or students seen as "experts" in certain areas?

International Perspectives

When I was in China this past May and June, I was struck by the similarities between your LIS schools and ours in the challenges we face. We do not have the same challenge as you of being assigned students who originally wanted to go into law or economics. Nor do we have the same challenge in fundraising for resources. Our alumni donate money to our programs, and we have many opportunities for government and foundation funding for research and teaching. We are able to charge significant tuition to our students and some or all of that tuition is usually returned to our schools. The level of funding our schools receive is obviously important, particularly because technology has become so essential to how and what we teach our students; but funding is relative. Most of the recommendations I have made about embedding our programs in our universities do not depend finally on money. They have to do with standards we set for our faculty and ways both faculty and administrators interact with the campus.

The most important decision any one of us makes is who to hire and to retain on our faculty. This is true in the United States, in China, in any university program. Those of us who are administrators often have the final authority on personnel decisions, but in my experience few of us find it easy to decide *not* to hire or retain someone. All of us, wherever we live, can set high expectations for the quality of faculty work; we can work together on exchange programs to broaden the knowledge and perspectives of our faculty; we can strive to improve our doctoral programs so new faculty have the in-

telligence, training, and socialization necessary to be successful university colleagues.

In China, where you do not have the same process of selecting students, is it possible to encourage those students who wanted to study law or economics to exert campus leadership in areas of intellectual property rights and e-commerce? I have been impressed with the Chinese undergraduate students I met on my previous trip. There is now a group of students from the University of Illinois working with a group from Peking University—exchanging ideas, teaching each other about the different curricula, and talking about mutual interests. Bringing this same energy to internal, on-campus collaborations will raise visibility of the LIS programs.

I am equally impressed by faculty I have met—their energy, dedication, and thinking about the future. You, in China, have the special advantage of living on your campuses; this means you have the opportunity to get to know faculty from other disciplines to make work connections. Perhaps this is not the way you have thought about the way you spend your outside-of-work time, but is it possible to do so? I have found that some of the partnerships we have arranged between our LIS school and other schools on campus, like Engineering or Speech Communications, developed after talking to someone while riding the bus or taking our children to school.

Finally, your schools have been renamed "information management." It is a powerful term, a name many schools in the United States have sought to acquire (to the dismay of the library profession). To what extent can the broader mission implied by that name be communicated to other departments in your universities?

Conclusion

A number of years ago I wrote about the socialist library trying to exist in a capitalist society. Universities around the globe are shifting increasingly toward capitalistic models of operation. Regrettably, departments are measured less on what they contribute to society or to the public good than how they contribute to the economy and the economic well-being of the campus. Those of us committed to this profession and to the vitality of our schools of library and information science must weave a spider web of involvement in our institutions. We must find ways continually to assert our value to the broad academic enterprise; the excellence of our faculty, staff, and students; and the ultimate value to society of our research and the work of our graduates.

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Information Science Facing the 21st Century

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Abstract: *With the advent of the information age, the digital revolution is causing profound changes and great leaps forward in information science. Information science and library science, archival science, and the related disciplines of editing and publishing are moving toward integration, and are intersecting and merging with other disciplines to form a cross-discipline. Information science has already become a major subject structure, and research in information science currently revolves around information and society, information services, and information and learning. It is evolving in step with the orientation of social needs and technological progress, and the best prospects in history stand before it.*

The information economy will flourish in the 21st century, and it will be an unprecedented era of information for humanity. The digital revolution and the development of the World Wide Web have caused enormous changes in the information environment. The networked environment of the Internet has transformed the traditional, ineffective, and closed structure of the library, its work model, and its means of providing service. The library is poised to go beyond the limitations of a brick and mortar location and service based on documents. It will use digitization, computerization, virtualization, and networking to its advantage. This is an era of extremely rapid growth, providing the greatest opportunity to develop a new theory, new ideas, and new ways of thinking. Information science is welcoming the springtime of its development.

Information Science is Not a Unitary Discipline

The field of information science has developed from our years of experience in collecting, processing, storing, disseminating, and serving human knowledge so that it may become the spiritual and physical wealth of humankind. From the basis of this knowledge we stimulate progress in science and technology, and economic and social development. Research in information science must involve those who work with the information and those who use the information. It must involve the documents and information, and must include the various principles for collection development, processing, storage, dissemination, and service of information, as well as methods and techniques. As the American information scientist J. M. Griffiths wrote in a recent article, information science contains three major components: people, recorded information, and tools (Griffiths 2000). Currently, worldwide research in information science is primarily concentrated in three fields (Wu 1997):

1. Information and society. Topics include the relationship between information and social progress, information and its impact on information services and the information industry, information and economic activities, information theory, intellectual property, information crime, and so on.
2. Information and service. Topics include information demand, information behavior, information organization, information systems planning, natural language processing, human-machine interfaces, editing and publishing technologies, information service and management, the establishment and use of digital libraries, the interaction between and mutual development of traditional media and new media, knowledge discovery, standards for digital databases, and so on.
3. Information and learning. Topics include the psychology of learning, information retrieval education, user studies, knowledge and information management processes, and information acquisition, and so on.

From this, we can conclude that information science is no unitary discipline. Rather, it is made up of 30 or 40 major disciplines and involves an integrated frontier discipline that includes natural science, technology, and social science. The overarching goals of information science education in China and abroad include from five to eight professional directions.

They include information theory and methodology, information analysis and inquiries, information resource management, computer information systems engineering and networks, the economics of information, management of knowledge, information retrieval, and metrology. They comprise some 30-odd disciplines including telecommunications, computer science, artificial intelligence, documetrics, system theory, control theory, information theory, archival studies, cataloging studies, library science, linguistics, editing and publishing, psychology, behavioral science, management science, linguistics, semantics, semiotics, recognition science, logic, recognition modeling, communication science, intellectual property, knowledge management, coding, lexicography, computer networks, digital database technology, information retrieval, economics of information, information analysis methods, and so on.

Information Science's Orientation to Social Demands and Progress in Science and Technology

Information science has evolved out of library science and archival science. Generally speaking, the discipline has moved through five stages in its history. In the 1950s, there was the integration of documents and technology. In the 1960s, the emphasis in research was on fundamental technology for information management and on raising the efficiency of traditional information management work. In the 1970s, the main thrust of research was toward automating information management, linking catalogs, and establishing automated information retrieval systems. In the 1980s, the emphasis was on developing linked information systems, moving to the use of local area networks (LANs), and modern information analysis research and support from decision technology. In the 1990s, the central efforts in research went toward computer information systems and placing information on the World Wide Web (Higher Education Publishing House 1999).

However, in the final years of the 20th century, with the unprecedented, rapid development of the computer industry, the launch of communications satellites, the broad spread of the Internet, and many other successes, information science was contemplating a much broader space for its development. We have already seen that computer technology, network technology, communications technology, and similar fields are rapidly being linked, and the differences between the collection, management, storage, and dissemination of information are rapidly disappearing. Users at tens of thousands of geographically disperse organizations need only click a mouse to retrieve information from the most remote places. Moreover, with the constant expansion of digitization and networks, printed documents, sound, and images are all being integrated and placed on networks. A huge number of organizations, and even households and equipment, are connected to the Internet. Globally, there are 300 million Internet users. As the networks have developed, there has been a dramatic increase in the digitization of information. People can freely access information from distant locations, have interpersonal interactions, and use video on demand to enjoy interactive entertainment. Still, people are demanding more. They want to be constantly served with information, 24 hours a day, 7 days a week, 365 days a year. When they want a book or a piece of information on the Internet, they want to find it within seconds. Technologists want 3D visualization of scientific calculations, engineers and designers want visual 3D CAD, and manufacturers want 3D visualization of manufacturing processes. Traffic management, air traffic control, and law enforcement all want 3D visualization. The more society advances, the more it demands visualization of its information, and the more it demands customized services. Apart from this, people want to be able to share resources; they also want a high degree of reliability, economy of cost, protection of privacy, protection of intellectual property, and so on. All of these demands, plus the progress in technology, have placed new tasks and challenges before information science and have spurred a burst of creativity and progress in the discipline.

The research focus of information science, library science, and archival science has shifted first from the document as the unit of information to knowledge and information organization, and then to research on the general principles of collection, processing, storage, transmission and development, and use of modern document information sources. Although information science, library science, archival science, and the allied disciplines of editing and publishing have had different histories of birth and development, they are now moving in the same direction with respect to research, environment, and development of goals. Moreover, the directions of these disciplines, whether in structural orientation or in systematic and knowledge orientation, have tended to coalesce. Of the 20 leading American schools of library science, ten have already changed their name to "institute of information science," and 14 schools in Canada have also done so. This demonstrates the tendency toward a merger of library science, information science, and archival science.

The foundation of information science, library science, and archival science is the document as an information source, and the form of document information sources in digital collections is the digital library. Many nations are establishing digital libraries. For example, in September of 1994, the U.S. National Science Foundation announced a four-year, US $24.4 million "digital library plan." In October of that same year, the U.S. Library of Congress initiated a project to gradually digitize the library's entire collection, and to lead and assist the nation's public and research libraries in digitizing books and periodicals, images, manuscripts, and photographs so that they might be stored in a high-resolution digital format and served over the Internet. Afterwards, France, Japan, Germany, Russia, and Singapore began to establish digital libraries. On May 29, 1995, France, Japan, the United States, Britain, Canada, Germany, and Italy met in France to establish the G7 Global Digital Library group; Rus-

sia later joined this project to provide a digital library for a global information society. The aim of this project was to take existing digital items and organize a large-scale virtual repository of human knowledge, which could serve a great number of people via the Internet.

In 1996, the Institute of Scientific and Technical Information of China began to implement studies on a digital library demonstration system, distributed databases, and a Western language linked catalog system. The Institute is currently planning research on key technologies and applications of the networked technology information service system. This includes natural language processing (automatic segmentation, automatic parsing, and automatic abstracting), research and applications on human-machine interfaces (information visualization technologies, improved technologies for information retrieval models, multilingual indexing, image indexing, language indexing, knowledge indexing), improved technology and applications for machine-readable forms, information digitization technologies (handling digitization of multimedia, semi-automated digital database technologies, high-volume digital storage and compression technologies), multimedia information standards, data mining technologies, and so on.

On August 25, 1998, the Ministry of Culture established the Chinese Digital Library Project Planning and Leadership Committee, and in December of the same year, the National Library began to develop its pilot digitization system. In May 1999, the National 863 Hi-tech Programa in Information established the Chinese Digital Library Development Strategy Group to research the technology, management, operation, and legal aspects of the project. Key technologies for networking information service systems and establishing digital libraries will greatly promote the growth of the technical information sector and the development of information science. Particularly in the case of information science, an entire series of new cross-discipline curricula can be created from computer science, communications engineering, linguistics, recognition science, control theory, systems theory, artificial intelligence, logic, psychology, and computational studies.

The age of digital knowledge will have an enormous impact on and present great challenges to libraries and information organizations worldwide. Computer and remote control technologies are currently changing the production, storage, acquisition, dissemination, and conservation of knowledge. High-speed wide-area networks have made it possible to obtain knowledge on a global scale, and digitized sources and related services will replace today's sources and equipment. The varied demands of users means that librarians will be the first affected by advanced technology. Libraries and information organizations everywhere will begin to abandon traditional card-based information indices and service methods that disseminate the original, and develop modern methods based on document information service systems through computer networks. This will represent a move from the traditional, closed document information system model toward an open, networked, digitized information service model. Information science will evolve toward helping people to search for and use information, and toward designing suitable practices and navigation aids that allow people to effectively and more quickly use knowledge and information, establish individualized searches, use information and knowledge pathways, and locate related information and knowledge.

Since people use different methods and different theories to research information organization, many different models have appeared: the scientific model, the pragmatic model, the recognition model, the behavior model, the dissemination model, and the coordination model. Scholarly debate is flourishing, and even the term "information" has several dozen definitions (Griffiths 2000, Higher Education Publishing House 1999, American Society for Information Science 2001).

Prospects for the Development of Information Science in China

According to a 1998 analysis by two information specialists at Nanjing University, the field of information science in China has been through five phases to date: (1) the initial phase (1956-1965); (2) the slump phase (1966-1976); (3) the recovery phase (1977-1979); (4) the growing phase (1980-1991); and (5) the transition phase (1992-present) (Shen and Ni 2000). I believe there are many signs that herald the ending of the fifth phase, the transition phase, and the entry of the discipline to the 21st century, a new phase of rapid development.

First, in October of 1992, at the eighth National Technical Information Workshop, the National Science Committee announced a decision to change the discipline name Science and Technology Intelligence [qingbao] to Science and Technology Information [xinxi]. This decision caused an immediate stir throughout China's technology information sector, particularly in the schools of higher education. This decision has been the greatest issue in China's information sector, and the argument goes on to this day. Not long afterwards, most of China's graduate schools of information changed their names in accordance with the announcement, and most tertiary schools changed the name of the Department of Library Science to the School of Information Management. It is particularly noteworthy that in April of 1999, Wuhan University, which is especially strong in information education and technological research, merged its School of Library and Information Science with its School of Journalism, changing the name of the resulting entity to the School of Mass Communications and Information Management. Now, all the departments of "library science" in higher education have changed their names. The change in name has broadened the scope of service and the span of the academic field, while, at the same time, departments and schools in tertiary institutions are being consolidated and academic departments are being merged. This is history, and history cannot be changed. Re-

cently, Dean Ann E. Prentice of the University of Maryland's graduate school visited China, and we spoke of why schools of information in the United States, Canada, and Australia were all changing their names to "School of Information Studies." She said: "The change in name is chiefly to broaden the scope of the discipline. In the past, things were primarily concentrated on information services, and now it has broadened to include information technology, systems design and management, knowledge management, computer networks, digital libraries, and so on." Thus it can be seen that changing names in China and in other countries might be viewed as "two paths leading to the same destination."

Second, in June 2000, the Institute of Scientific and Technical Information of China held the National Science and Technical Information Organization System Reform and Development Symposium. This meeting assigned some new tasks for the next steps in the organizational reform and development of scientific and technical information organizations. People had a deeper consciousness of the position and functions of the scientific and technical information organization in the new era, and also showed considerable preparation on the topic of systematic reform. The meeting emphasized how to fully develop an information organization's systemic advantage under a new form and how to serve decision-making with an innovative spirit.

Soon after the meeting, new prospects emerged for the field of science and technology information. At the top levels of the central government, eight organizations jointly launched the "virtual document center" to further promote the joint development and sharing of China's science and technical information. They were the Chinese Research Institute of Scientific and Technical Information, the Library of Chinese Academy of Sciences, the Information Center of Chinese Academy of Agriculture, the Information Research Institute of Chinese Academy of Medicine, the Chinese Chemistry Information Center, the Mechanical Information Institute, the Metallurgy Standards Information research Institute, and the National Quality Technology Inspection Information Institute. In July, the Chinese Research Institute of Scientific and Technical Information, the Chemical Engineering Information Center, the Mechanical Information Institute, and the Metallurgy Standards Information research Institute jointly set up a "national virtual engineering technology library" to prepare for the construction of a national technology innovation system, science and technology information institute, and training of personnel. At the local level, there have appeared various types of reforms, such as mergers among libraries, the creation of new mechanisms for intellectual property reform, models of intermediary organizations for reorganizing units to modern business models, models using reform to the shares system to create a method of partial market entry, and a model of complete transition to business organization and direct entry to the market. There is also the China Trust model of the elimination of a portion of services and worker investiture—the Wanfang Digital Corporation model. In a word, science and technology information organizations are going through a major transformation and will be welcoming great new developments. This has created the environment for development in information science.

Third, the information revolution, with the Internet at its heart, is mowing down all resistance in its path. According to statistics released by China Internet Network Information Center (CNNIC) on July 27, 2000, as of June 30 of the same year, China had some 6.5 million computers connected to the Internet and could count 16.9 million Internet users. The number of domain names under ".cn" had reached 99,734, and there were 27,289 Web sites. Based on the current rate of development, by the end of 2000 China's Internet user population will surpass that of Japan and Britain to move into second place worldwide. According to projections, after about five years, China's Internet population will surpass that of the United States. The Chinese government went online in 1999, and 2000 is the year of enterprises getting on the Net. A great number of ISP, ICP, and ASP companies and enterprises have emerged. The Chinese Educational and Scientific Network and the Chinese Science and Technology Network have been successfully established for a number of years.

Most worthy of mention is that the Chinese Youth Development Foundation has recently promoted a "Rural Computer Information Pavilion" using photoelectromagnetic carriers to transmit educational and cultural products, and economic, scientific, and technical information to the rural areas. This will greatly expand the worldview of rural residents and raise the quality of scientific culture and information consciousness of young peasants. On September 28, 2000, the Rural Computer Information Pavilion was formally launched in Beijing's Great Hall of the People. Wenzhou City in Zhejiang Province led the way, bringing electronic information pavilions to more than 300 villages. The Chinese Youth Development Foundation plans to establish 10,000 rural computer information pavilions throughout China during the next three years. This plan will greatly stimulate the pace of informatization in China's rural society. Once China's peasants have been brought into the information age, the nation's entry into the information age will be complete, and the practicality of information science will be amply realized.

Fourth, in September 2000, the State Council Committee on Academic Degrees convened the eighth meeting of the Academic Discipline Review and Approval Committee. Some 22 institutions were approved to develop a master's degree in information science, including Peking University, Zhongguo Xiehe Medical Technology University, Beijing Normal University, Tianjin Normal University, Jilin University, Heilongjiang University, Huadong Normal University, Shanghai University, Nanjing University, Nanjing University of Technology, Wuhan University, Zhongnan University, Xi'an University of Electronics Technology, the Document and Information Science Center at the China Institute of

Technology, the Chinese Institute of Science and Technology Information, the Chinese Aviation Research Institute, the Chinese Institute of Traditional Chinese Medicine, the Institute of Military Medical Science, the Chinese Defense Technology Information Center, Hebei University, and Lanzhou University. Four universities were named to provide Ph.D. programs in information science: Peking University, Nanjing University, Wuhan University, and Jilin University of Technology. More units were named to cooperate in developing Ph.D. students, including the Chinese Institute of Science and Technical Information, the Document and Information Science Center of the Chinese Institute of Technology, and the Chinese Defense Technology Information Center. Institutions at which information science is a first-level discipline are Peking University and Wuhan University. These organizations are laying down an excellent educational foundation for the training of outstanding young talent in the field of information science in China.

Fifth, during the five decades since the founding of the People's Republic of China, the field of information science in China has seen the presentation of 18,369 scholarly articles (as of the end of 1998) in 11 broad categories. The order of precedence of these categories was, respectively, information organization management, fundamental information theory, information retrieval, information analysis, information services, information searching and collection, information technology, the information industry, the foreign information industry, information organizing, and information education (Wu 1997). According to an analysis by the Chinese Research Institute of Scientific and Technical Information on 577 master's degree theses produced between 1990 and 1999 in the field of information science, the rank of information technology moved up to fourth place. This shows that there was clear progress in information science in China during the 1990s.

Information technology has had a deep impact on information science, whether in terms of changes in curriculum design, faculty, or research fields. This includes the linkage between theory and practice, cross-discipline study, professionalism, and progressivism. Consequently, we can say that as China moves into the 21st century, information science in China has begun a new phase in its development. It will face social demands, bring in new scientific knowledge and technical successes, integrate practical applications, and enhance international scholarly exchanges, all of which will ensure a bright new day for the discipline.

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Notes from Translator

(a) The National High Technology Research and Development Program (863 Program) was launched in March 1986 with the aim of enhancing China's international competitiveness and improving China's overall capability of R&D in high technology. The Program covers 20 subject topics selected from eight areas: Biotechnology, Information, Automation, Energy, Advanced Materials, Marine, Space and Laser. See detailed explanation at www.863.org.cn/english/about_863/index.html.

The Role of the Dean in Implementing Change

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Abstract: *The article examines the role of the dean or director of schools of Library and Information Science in three critical areas: developing curriculum that keeps pace with practice; attaining resources for improving and developing the school; and creating an environment that fosters research.*

My paper today is concerned with three issues that, in my view are important to library and information science schools in both China and in the United States.

While it is certainly true that our LIS schools have developed very differently in the two countries, and indeed the system and the levels of instruction here in China are much more complex than in the United States, still I think that for those who are concerned with administering and improving LIS education, we have many more issues in common than we do differences. So my paper is primarily addressed to deans or directors of LIS Schools, and also to faculty, or doctoral students, or both who may aspire to be deans.

As some of you know, I have spent 19 of the last 20 years as a library school dean, so I hope that the issues I have chosen reflect reality. The issues I have chosen are as follows:

- Developing curriculum that keeps up with practice, along with better models for teaching;
- Getting the resources needed to develop strong LIS programs; and
- Creating an environment that fosters research including ongoing research and evaluation of LIS programs.

Developing Curriculum that Keeps Pace with Practice

We all know that a major interest of all LIS educators is: Of *what* should the curriculum consist? What are the courses that should be required? How much theory? How much practice? I agree that these are topics of critical importance that no doubt will be discussed in detail here this week, but I want to focus on the role of the dean or director in ensuring that the curriculum meets the following criteria:

- Encompasses the theory and techniques of library or information science or both
- Reflects the needs of current practice; incorporates a user perspective
- Uses a model of teaching that relies much less heavily on the lecture mode, and far more on an interactive mode with opportunities for students to solve problems and exercise their individual creativity.

The first and most basic criterion is that the curriculum encompass the theory and techniques of library and information science. This may seem obvious, but too often the curriculum is derived from tradition and from what other LIS schools include in their curriculum. While tradition and current curriculum choices of LIS schools should not be ruled out, too often schools plan a new or revised curriculum using only the expertise of their own faculty. It is common to exclude the participation of alumni, employers, and practitioners in the planning process. Current students are also often omitted from the planning cycle, even though they most often come to LIS school with strong experience that could be helpful in making decisions on what should be taught, and how courses should be modified and updated.

It is the role of the dean to establish a planning process that regularly brings together faculty, employers, practitioners, alumni, and students to evaluate the current curriculum and suggest new directions. Whether this meeting occurs once a year or once every two years, it must be conducted with enough regularity that the planning group is able to see that its recommendations have been followed, and that its work and participation are taken seriously by the school.

An added bonus in a school's maintaining close touch with practitioners is that it helps facilitate the placement process. As Larry Osborne and Li Chun Bo noted in an article describing placement of library school graduates in China (Osborne and Li 1990, 345), it is now the responsibility of individual graduates to locate their own positions; but the schools still have a strong obligation to assist the student.

In reading articles by Chinese authors, I note that some have called for a national approach to curriculum development. For example, Lu Shaojun, several years ago, called for "a national plan . . . that clarifies the divisions of specializations in LIS" (Lu 1994, 354). He then goes on to say "programs in different institutions should develop emphases appropriate to their faculty resources." This reinforces the idea of having a curriculum advisory group representing local and regional as well as national interests. In this same article, Lu says that the "structure of courses of study should be adjusted to meet social demand . . . and courses should be designed with future employment in mind." This can only be achieved by bringing employers into the planning process.

Having said that, I want to focus on the process of developing the curriculum rather than its content. I would simply make two general comments. The first is that the curriculum should have a decided user focus. As Robbins has expressed it: "From the perspective of librarianship, what undoubtedly distinguishes this field is its focus on the user. This takes precedence over emphasis on the information system (the focus of management information systems) or information technology (the focus of computer based information science)" (Robbins 1998, 20). The other thing we need to remember is the unique role LIS specialists have in teaching others to use technology to access information. No other discipline has this as a major function. The importance of training librarians who can interpret user needs to system designers is also sometimes overlooked in developing curriculum.

The third criterion for curriculum, developing interactive modes of teaching, is an issue for all LIS schools. In 1994, Liu Kejing wrote concerning the present model of teaching in LIS education, "with the exception of some applied courses such as cataloging and application of computers which require limited practice, teachers spend as much as 90 percent of class hours lecturing." While we may have had some changes since 1994 (the introduction of Web-based courses has forced some to rethink the design), it is safe to say that the lecture mode, which Liu Kejing deplores because "Students may become bored from such monotonous teaching methods," is the dominant mode in the United States as well (Liu 1994, 252).

Deans and directors cannot force their faculty to use a variety of teaching methods, but they can develop a climate that rewards experimentation with new ways of presenting content and encouragement of student initiative and interaction. You have all heard the old saying that "it's hard to teach an old dog new tricks" so I believe that incentives and rewards are necessary.

Often, the rewards and promotions in higher education go to the able researchers. This is as it should be, but there is no reason why creative teaching should not be rewarded as well. Each year at the University of Texas at Austin, the LIS students select "best teacher." This person is recognized at a university-wide ceremony and given a monetary award.

Attaining the Resources Needed to Improve and Develop the School

In my view, being able to garner the support needed to enhance the LIS program is the most critical role of the dean or director. There must be sufficient resources to hire and retain the finest faculty, and acquire the latest technology. Granted, there are other imperatives; but if the dean can manage to obtain these resources, the other problems are more readily solved.

According to Lu Shaojun, "In recent years the Chinese economic structure has changed from a 'planning economy' to a 'planning marketing economy' which combines elements of both planning and market economies. This change has heavily taxed the budgets of the traditional education system. Before 1990, any increase in expenses was covered by the government, so that no one worried about costs. Now the fiscal crisis has become a critical issue, with graduate LIS programs struggling to balance their budgets. Moreover, economic pressure has altered the structure of graduate LIS education, adding correspondence students and 'branch' institutions to the original structure" (Lu 1994, 353).

Similarly, in the United States there has been a shifting of responsibility for the funding of LIS programs. Most programs are dependant on the university for their funding, but, increasingly, the university expects that the LIS school will, on its own, bring in substantial amounts of new monies from research grants and from external donors. In recent years, the corporate sector has been a major source of both funding and technology resources for LIS schools in the United States, and the potential for similar kinds of partnerships in China would seem very promising as economic opportunities expand here.

The comments I made in 1998 on The Status of Library and Information Studies in the United States seem to be equally relevant today:

> The Dean must clearly comprehend the organizational dynamics that are operative within the University, and then work with faculty in positioning the school so that it is seen as not only well managed and productive, but also as making a unique contribution to achieving the goals and strengthening the reputation of the University…Unless the Dean and Faculty are able to achieve this kind of standing for the school, it is unlikely that the resources and incentives will be forthcoming to enable faculty to carry out the school's mission. This requires a shift in attitude that may be difficult for faculty who in earlier times were accustomed to arguing successfully for increased resources, thus enabling the

> school to initiate projects and fulfill objectives. Those days are gone and seem unlikely to reappear. Entrepreneurship is now the order of the day (Sheldon 1998, 68-69).

A dean must understand university guidelines concerning contacts with corporations, foundations, and government granting agencies. Most universities have a clearance system for these contacts, so that different departments within the university will not be contacting a donor at the same time. It is also essential to understand university policies about accepting gifts for the school.

In ensuring that a program receives its fair share of the pie, the most important considerations revolve around the LIS dean's relationships with the university administration and with the deans and directors of other colleges and schools on campus. The LIS dean's primary task is to educate the administration and his fellow deans about the importance and the special needs of an LIS school. The complexity here should not be underestimated. Key administrators very often have little understanding of what librarians do, let alone information scientists! Yet the dean must not appear to be an advocate only for the LIS School. It is essential to see the "big picture" of the total university and be able to take a broad perspective when budgetary and other critical decisions are being discussed. Persons with narrow, self-serving viewpoints will be less successful over time.

Whether working with the university administration, or externally with alumni, corporations, and other potential donors, it is the dean who must take the lead in building the resources of the school. In my opinion, at least 20 percent of the dean's time should be spent on this task, and more time than that if there is a special campaign under way.

Creating an Environment that Fosters Research

Closely allied to attaining resources is the important role of the dean in creating a positive environment for research in the school. Sometimes universities have a research program, which can allocate funds for faculty projects. Frequently it can be difficult for LIS faculty to compete with their colleagues in engineering, computer science, and other "hard sciences" since these disciplines and their research agendas are well established and understood. Deans can help junior faculty make contacts with faculty from other schools to work on interdisciplinary projects. With external funding, rewards for outstanding research projects within the school can be established. Encouraging and providing opportunities for faculty to become visiting faculty in other countries can be very helpful in forming networks and broadening research perspectives. Such simple devices as holding a "research day," where faculty and students present their work to their peers, can be very effective. In China, where the norm is to require a master's thesis, there are many opportunities to highlight the work of faculty and students.

Finally, a dean should set a good example, and show that he or she is superhuman by finding time to do some research as well as teaching.

This has been an attempt to talk about the dean or director's role in a number of important areas. Of course, I have neglected a number of important roles, but I think perhaps the most critical point to be made is the need for the dean to refrain from burying faculty in too many committee appointments and other chores that are routinely done by faculty. It is true that the faculty, when it comes to academic matters, must be the decision makers, but they will never become strong researchers and creative teachers if they are bogged down with administrative tasks. We should ask ourselves, if we are going to put faculty member X in charge of internships, what kind of administrative support will he or she have? The role of dean is, as I see it, to do what he or she does best; that is, manage the school by organizing and delegating routine tasks to staff so that faculty can do what they do best: research, write and teach!

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Again on the Development of Our Discipline:

Suggesting "Information Resources Management" Be Our First-level Discipline

(summary)

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An American scholar says, "If library education fails, then librarianship fails." We can also say that if we still need libraries, we should continue developing library education.

At present, both at home and abroad, traditional print media are still developing. Libraries are also still developing. However, library science education has shrunk greatly. Library science specialties (4-year undergraduate courses) have decreased from more than 40 to 20, and many of these 20 have not enrolled new students for many years.

I will not mince words: two things account for this occurrence. First, there are some problems in our understanding of the innate character of our discipline and related disciplines. Second, the trend to rename "library and information science" to "information management" or similar terms has confused us.

I have consistently said that we must give a good name to our first-level discipline (it is now called "library and information science and archival studies"), and I remain firm that we should continue developing our second-level disciplines: library science, information science, and such. We must not "desalinate" them, still less replace them with any other disciplines, even the first-level discipline. There are two reasons for this.

First, because society still needs libraries, it is necessary for library science to continue developing. The library is one of the basic facilities in a society—a knowledge management and navigation center. We count on libraries to preserve and disseminate knowledge over time and space. The library is where people can go to acquire knowledge throughout their lives, and it is one of the main resources for people to accumulate "the goods of the mind." Adler says that there are four kinds of "goods of the mind": information, knowledge, understanding, and wisdom. I would propose some refinements: printed materials and data, knowledge, intelligence, and ability and wisdom.

Libraries and information centers provide many services: collecting and arranging information and data produced by various trades, analyzing and processing the information into knowledge, and activating them into intelligence. The collection, arrangement, analysis, processing, and application of information are within the scope of study and practice of library and information science.

We should jointly develop our first-level discipline. At present, I suggest that it be Information Resource Management (IRM). Many colleagues share my opinion, and the name may be acceptable to society (including academic circles) and the relevant authorities. In my heart, I prefer the name Knowledge Organization and Management, but that would be even more difficult for society to approve.

Rationale for IRM

There are three main reasons why I believe we should make IRM our first-level discipline. First, it would convey the innate character of our discipline. Second, it would broaden students' range of knowledge so as to improve their intellectual framework. Finally, it would train library and information service professionals in ways that meet the information needs of society.

Meaning of IRM

Information Resource Management mainly studies the theory, technology, and methods applied by an organization to realize its strategic goal of managing information resources (print and electronic) and related systems, equipment, personnel, and the like.

Discipline System

The system within the discipline of Information Resource Management would include basic theory (the principles, philosophy, and history of IRM); subordinate disciplines (such as library science, information science, and others); management of fields (resources, technology, and service management); and the management of professional work, such as leadership and planning.

Classification of Courses

I would suggest the following classification of courses:

- Methodology
- General introduction to IRM
- Information resources organization and management (e.g., information sources and service, information resources organization, storage and retrieval, and information user studies)
- Information technology and information systems
- Information economics
- Information sociology, and others.

The Reformation and Innovation of Library Science Education in the Digital Age

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Abstract: *This paper takes a comprehensive look at the past 50 years of library science education since the founding of the People's Republic of China and describes the impressive achievements made in library science education during the 20 years of China's opening up and reform. The paper also makes several points on issues regarding the development of library science education in the new century. The author stresses the importance of reinforcing efforts to create master's degree programs of library science in order to train qualified library science professionals in the broad disciplines of library science, information science, and archival studies.*

The Development of Library Science Education in Modern China

The development of advanced library science education in China goes back 80 years, beginning with the establishment of the Wuchang Wenhua University Library Science Department in March of 1920. In the early period after the founding of the People's Republic of China (PRC), there were three main centers of high-level library science education in China:

- The once privately-run Wuchang Wenhua Library Science Training School, taken over by the Cultural Bureau in August 1951. Its leadership was entrusted to the Education Department of the Zhongnan Military and Political Committee, and in 1953 following restructuring of faculties it was merged with Wuhan University to run a sub-degree course in library science. It later evolved into a key base for library science education in China.
- Peking University, which in August 1949 began to enroll high school graduates in its library science sub-degree course (originally under the Faculty of Arts) and later grew to become another key center for library science education in China. As the intake of students expanded, new teachers were brought in, course content was restructured, cultural science knowledge was expanded and teaching methods reformed, and teaching quality of these two sub-degree courses was improved.
- Southwest Teachers College, which in 1951 established a sub-degree course in library and museum science, but was discontinued three years later.

Therefore, soon after the establishment of the PRC, the two centers continuing to run library science sub-degree courses were Wuhan University and Peking University.

In 1956, both Peking University and Wuhan University changed their sub-degree courses in library science into regular four-year undergraduate courses and officially established library science departments. Under the leadership of the Ministry of Education and the Ministry of Culture, the two departments formulated new teaching plans to adapt to the upgrading of the courses and set new training objectives. The ministries of culture and education selected cadres to study in the Soviet Union at the Moscow Institute of Library Science. Some of them pursued doctoral degrees. In 1958, the Cultural Institute of the Ministry of Culture established a research class in library science, the Scientific and Technical Information Science Department of the Chinese University of Science and Technology established a sub-degree course in library science, and the Hebei Culture and Art Cadre School and Northeast Normal University also established sub-degree courses in library science. These departments only taught for a brief period before some were merged with other institutions and others were closed.

The Great Leap Forward[a] of 1958 had a negative impact upon library science education. After 1961, China entered into a period of restructuring and consolidation, managing to compile relatively high-quality teaching materials. The Cultural Revolution,[b] initiated in 1966, saw attacks on library science education and the discipline was badly mistreated.

The library science departments of Peking University and Wuhan University, which had remained the only departments for library science education throughout China, stopped enrolling students and then suspended classes. Professional education was brought to a standstill. In 1972, the library science departments of both universities began enrolling students again after a hiatus of six years. After the 10 years of turmoil of the Cultural Revolution ended, library science education entered a new stage of development. This was primarily manifested in the following four ways:

(1) The number of professional schools increased and a system of multi-leveled schools of various types began to take shape. After the national college entrance exam was restored in 1978, the number of schools teaching library science and information science increased rapidly; today, there are 55 professional institutes of higher learning that have library science and information science departments. In 1978, the central government made the decision to restore postgraduate education. In the same year, the library science departments of Wuhan University and Nanjing University took the lead and enrolled the first class of students to pursue the master's degree of bibliographic science. Later, Wuhan University, Peking University, and East China Normal University all began to enroll students to pursue master's degrees. On January 1, 1981, the "People's Republic of China Regulations on Academic Degrees" was officially implemented. On November 3 of the same year, Peking University and Wuhan University became the first universities to obtain authorization from the State Council Degree Committee to run master's degree courses in library science.

Following the seventh degree authorization examination and verification of the State Council Degree Committee, three centers were authorized to confer doctoral degrees: Peking University, Wuhan University, and the Bibliographic Information Center of the Chinese Academy of Sciences. At the same time, Wuhan University and Nanjing University (jointly with the Bibliographic Information Center of the Chinese Academy of Sciences) and Peking University (jointly with the Chinese Science and Technology Information Research Department and the Chinese National Defense Science and Technology Information Center) were authorized to confer doctoral degrees. In addition, 13 centers were successively authorized to confer master's degrees in library science and 18 centers were authorized to confer master's degrees in information science.

At the end of 1998, there were 1,465 master's degree graduates and 43 Ph.D.s in library science and information science trained through China's own system. They are becoming the backbone of departments in the field. Some of these graduates are academic leaders in the discipline. The field of library science education in China has now developed into a relatively complete, multi-level and multi-faceted education system comprising doctoral degree courses, master's degree courses, bachelor's degree courses, sub-degree courses, and adult continuing education.

(2) Library science has become well established in the professional education system. From the 1980s to the mid-1990s, the *Catalog of Disciplines for the Conferral of Doctoral and Master's Degrees and the Training of Postgraduate Students* did not clearly define the category for conferral of the library science degree. Initially, it was attributed to the Arts category and later to the Science category with Doctor of Science or Master of Science degrees conferred as a second-level discipline under the first-level discipline of Systems Science, Library Science, and Information Science.

Subsequently, the category of Management Science was added and the discipline of Library and Information Science and Archival Studies was established as a first-level discipline under that category. Library science, information science, and archival studies were also separately established as three second-level disciplines. It is generally accepted that the problem of which category the discipline should be attributed to has been resolved. In general, a first-level discipline is used for laying the foundation for the training of postgraduates, a second-level discipline is used for improving the level of training, and a third-level discipline is used for determining research direction. The new postgraduate discipline catalog benefits the expansion and breadth of professional training and also aids the examination and verification of the conferral of degrees as a first-level discipline. Library science and information science are both independent entries in the *State Social Science Funding and Subsidies Guide*, thereby establishing the independent status of the two disciplines in the area of philosophical social science.

(3) Teaching and research were closely linked, and new teaching materials were developed to enrich course content and raise teaching standards. Teaching and research complement each other; linking them can enrich course content by supporting the development of new teaching materials. Before 1978, there were few publicly published library science teaching materials. In 1978 in Wuhan, the Ministry of Education convened a nationwide Arts Course Teaching Symposium for Institutes of Higher Learning. Subsequently, library and information science fell under the arts course teaching material planning for institutes of higher learning. Between 1978 and 1983, there were eight categories of teaching material published. Between 1985 and 1990, under the Institutes of Higher Learning Arts Course Teaching Material Compilation Plan, there were more than 60 kinds of material published in addition to the self-compiled teaching materials and resources of colleges, universities, and the Bibliographic Information Center of the Chinese Academy of Sciences. The unique features of these teaching materials are that, first, there is a full range of materials for different subjects, such as a library science series, an information science series, a bibliography series, and a library information science automation series. Second, the teaching materials are clearly divided into different levels. Sub-degree course, undergraduate course, and postgraduate materials were compiled according to the requirements of the different educational levels. At the same

time, teaching materials were also published for use by students in distance learning institutes, as examination and self-study guides, course-compiled textbooks, teaching guidebooks, teaching reference books, teaching syllabi, and other supplementary materials. Third, there are many different kinds of teaching materials, ranging from those selected and compiled by the Ministry of Education to audiovisual teaching materials. In brief, the amount of teaching materials increased and their quality also continued to improve. The State Education Commission certified publications such as *Basics of Library Science, A Brief Introduction to Bibliographic Science, Usage Methods of Chinese Reference Books,* and *Retrieval Methods for Scientific and Technical Literature* as "Excellent Teaching Material" in 1988.

(4) Training objectives were restructured, and a sound and clearly classified library science education system was established. Providing education at different levels is based on the actual conditions in China and is an important guiding principle in the development of tertiary education. Since the founding of the PRC, and especially after 1978, a number of revisions have been made to the academic program for library science.

The Ministry of Education's *Regular Institutes of Higher Learning Undergraduate Course Discipline Catalog and Introduction,* published in 1998, states the training objectives for undergraduate students in library science: "This discipline develops high-level, specialized and qualified personnel with a systematic and thorough knowledge of the basic theory of library science, skilled in the collection of information using modern technology and with the ability of collating, developing and utilizing documentary information for use in the service and supervisory areas of libraries and information institutions and information departments of various enterprises and public undertakings."

According to the regulations of the *Brief Introduction to the Conferral of Doctoral and Master's Degrees and the Training of Postgraduate Students,* recipients of a master's degree of library science must have an overall development of morality, wisdom, and physical culture; possess a strong and broad fundamental knowledge of library science; and exhibit systematic and in-depth expertise and strong integrated qualities and abilities. They should be proficient in a foreign language, well versed in the use of computers, and understand the present status and development trends in the area of research they undertake. They should be able to carry out scientific research independently and handle high-level supervisory work in medium-sized and large documentary information organizations. Recipients of doctoral degrees should have an overall development of morality, wisdom, and physical culture, possess a strong and broad basic theory of library science as well as systematic and in-depth expertise and excellent synthesized qualities and abilities. They should have a comprehensive in-depth understanding of the history, present status, and frontier of the research they undertake. They should be proficient in one foreign language and able to read academic literature in a second foreign language and be able to independently carry out innovative research. They should be able to carry out teaching and research work in institutes of higher learning or high-level supervisory work in large documentary information organizations.

We believe that the revisions to the catalog of disciplines are not something that can be done only once, but rather that each revision is a single step forward. From now on, following advances in science and technology, society, and economic development, and with a deepening of peoples' awareness, the catalog of disciplines will be gradually restructured and perfected. However, the different levels of training objectives should all have a central core.

In brief, since the founding of the PRC, library science has undergone a reform and development process, evolving from a simple teaching system to a relatively complete, multi-level and multi-faceted education system. Course content has gradually become more complete and more abundant. In the last 50 years of development, library science education has achieved impressive results. Looking toward the digital age of the 21st century, library science education will encounter many challenges that are worthy of further contemplation.

Reflections on Library Science Education Innovation in the Digital Age of the 21st Century

1. Qualified library science professionals should be highly educated in the first-level discipline of library and information science and archival studies. It is especially important to reinforce the creation of master's degree library science courses in the first-level discipline.

On November 3, 1981, Peking University and Wuhan University became the first learning centers authorized by the Degree Committee of the State Council to run master's degree courses in library science. After two decades of painstaking efforts, encouraging achievements have been made in library science, information science, and archival studies degree courses and postgraduate education. As a result of seven years of authorization examination and verification, China now has three centers authorized to confer doctoral degrees in library science: Peking University, Wuhan University, and the Bibliographic Information Center of the Chinese Academy of Sciences. Wuhan University and Nanjing University (jointly with the Bibliographic Information Center of the Chinese Academy of Sciences) and Peking University (jointly with the Chinese Science and Technology Information Research Department and the Chinese National Defense Science and Technology Information Center) have been authorized to confer doctoral degrees in information science. In the meantime, 13 centers have been successively authorized to confer master's degrees in library science and 18 centers have been authorized to confer master's degrees in information science. A relatively complete, multi-level, structured and rationally laid-out library science, information science

and archival studies education system has begun to take shape. By the end of 1998, a total of 1,465 masters and 43 doctors of library and information science and archival studies had been trained through China's own education system, providing China's library and information science, educational, scientific, research, bibliographic, and information organizations with urgently needed highly educated, specialized, and qualified personnel. The postgraduates we have trained are now emerging as the mainstay of various departments, receiving the approbation of their employers and being assigned to important positions. Some individuals have already become academic leaders in their fields, establishing an excellent foundation for the training of master's and doctoral candidates in library and information science and archival studies.

The implementation of the regulations on academic degrees and the establishment of authorized centers for the conferral of doctoral and master's degrees have promoted the development of, and scientific research within, the disciplines of library science, information science, and archival studies. Discipline development and the establishment of authorized centers for the conferral of degrees have a mutually impelling influence. Generally speaking, whether master's and doctoral degrees can be granted for a certain discipline is an important indicator for judging the level of that discipline. The centers of learning authorized to confer doctoral and master's degrees standardize their training elements and process management in accordance with the requirements of the regulations on academic degrees, enriching and developing their strengths and enabling the centers to better undertake their missions of research and produce high-level qualified personnel. Development of the discipline is mainly reflected in the results of scientific research and training of high-level qualified personnel. Only high-level centers of learning can undertake important research and train high-quality postgraduate students. High-level research and development work can supply postgraduate students with leading-edge research subjects. Postgraduates must explore and participate in leading-edge research and develop and increase their skills through the research activities. At the same time, postgraduates are not only the able assistants of tutors in their scientific research, but also an energetic group of fresh troops for research. Their thinking is animated and they are full of innovation and spirit. Under the guidance of their tutors, they carry out scientific research at the forefront of their discipline, propelling library science, information science, and archival studies to a higher level.

The *Catalog of Disciplines for the Conferral of Doctoral and Master's Degrees and the Training of Postgraduate Students* lays an important foundation for the optimization of postgraduate training programs. It enhances the quality of graduates, and positively influences graduate enrollments, training, conferral of degrees, degree authorization examination and verification, quality evaluations, and development of the discipline. If our graduate education in library and information science and archival studies is to give full play to its vital role in societal development, we must seize all opportunities and continue the reforms within these disciplines.

In 1998, the catalog of disciplines was revised, and listed Library and Information Science and Archival Studies as a first-level discipline under the Management Science category. The revision saw the disciplines of library science, information science, and archival studies suitably categorized. This benefits the broad development of graduate students and makes it possible to carry out examination and verification of the authorization for the conferral of degrees as a first-level discipline.

We know that library science, information science, and archival studies are important constituents of modern management science, being those sciences that research the structure, collection, organization, transfer, development, and usage patterns of documentary information and resources. They take the informatization of modern society as a backdrop and grow from the actual needs of informatization development and the information requirements of users (readers) researching new models and technologies of library and information science and records management in the modern network environment. Although the creation and development of library science, information science, and archival studies have different backgrounds and historical processes, they are all developing disciplines that have undergone profound changes. Following the trend of integrating disciplines, education in library science, information science, and archival studies is also showing a tendency toward amalgamation. This has provided an excellent foundation for verifying the authorization for conferral of first-level discipline degrees. Only by expanding the scope of graduate training can we give graduates a solid and broad academic foundation. Only by establishing a wide platform of basic knowledge can we be prepared to adapt to the demands of the informatization of society and the development of the intellectual economy, training graduates with the ability to innovate.

The teaching of undergraduate students in library science should aim to produce qualified personnel with many abilities and practical knowledge. In China's degree system, the master's degree is a first-level independent degree. We believe that the master of library science degree should be structured according to the requirements of master's degrees in applied disciplines, emphasizing the practical orientation and linking it with the real demands of libraries and information organizations. Candidates for the master's degree should be trained broadly to strengthen their adaptive abilities and give the degree a focus on the business requirements of employers. A relatively long period of study is required for the conferral of a doctoral degree of library science. Innovation is the core requirement for doctor of library science candidates and an appreciation of innovation should be brought into every element of candidates' training.

2. Educational concepts should be transformed, and innovation and multiple skills should be fostered.

With its swift development, technology has a growing influence on today's economy. The pace of discovery of new knowledge is also increasingly rapid and means for the dissemination of information are more and more advanced. To adapt to this new state of affairs and to meet new challenges, we must further reform library science education. The reform must be based on society's needs for qualified personnel and the objective laws of library science education. In the reform of library science education, we must transform educational thought and ideals into the precursors of reform. In March 1996, President Jiang Zemin,[4] when meeting with the heads of four of the leading Chinese communications universities, proposed two transformations for education. First, education must fully adapt to the demands of modernization for the training of all kinds of qualified personnel; second, its quality and efficiency must be boosted. Quality is the lifeblood of library science education. To bring a well-structured, high-quality and high performing library science education system into the 21st century, we must focus our work on optimizing structures, upgrading quality, and developing content. These are the demands of the times and are also the inexorable laws of the development of library science education.

Presently, there is stable growth in the number of centers teaching library science, but they are not well distributed. There are too many centers of the same level concentrated in the same area, with relatively few sub-degree and technical secondary school courses. The conditions at some teaching centers are quite poor, with a low level of teaching staff. Many have inferior educational backgrounds, yet they blindly pursue the right to confer degrees.

Whether master's and doctoral degrees can be granted for a certain discipline is an important indicator of the level of that discipline. However, the satisfactory conditions for training graduates, especially the establishment of high-quality degree courses and the development of high-level teaching staff, must be built over time. Now there is a basically rational structure with three authorization centers for doctoral degrees and thirteen for master's degrees in library science. Therefore, library science education should not now focus on expanding the number of centers that have the right to confer doctoral and master's degrees. Rather, it should place its academic focus on developing the discipline at a fundamental level, raising the quality and efficiency of teaching, and developing high-quality content. We must educate students to develop a concept of quality and stress an overall development of morality, education, and physical culture, thus bringing the spirit of education into the overall educational process. The reason for boosting teaching quality is to develop students' ability to innovate. As President Jiang Zemin has said, "Innovation is the soul of a nation's progress and an inexhaustible power for the prosperity and development of the nation." To develop students' ability to innovate, we must first properly manage the relationship between carrying forward knowledge and innovation. We can realize innovation only on the basis of knowledge carried forward. Second, we must create an academic environment conducive to the development of students' ability to innovate. This includes establishing leading-edge special subject lectures, employing eminent academics and scholars from both home and abroad, promoting democratic teaching methods, raising awareness throughout the student body, strengthening academic exchanges, and activating students' academic thinking.

3. Development of the discipline should be reinforced and concurrent improvement promoted in the quality of scholarship and teaching.

Development of the discipline is the central manifestation of the level and structure of library science education. Only by using high-level discipline development as a foundation and support can Chinese library science education improve its quality and take a place among the ranks of the world's finest library science education systems. Development of the discipline is mainly reflected in the results of scientific research and training of high-level qualified personnel. The development of degree courses is the most important indication of the development of the discipline of library science. It is itself a product of this development and is also a principal driving force behind the development of the discipline. Highly qualified personnel can be trained and high achievement reached through the development of authorization centers for degrees. High-level centers conferring degrees can undertake important research and development work and provide cutting edge research subjects. Postgraduates can explore and participate in such research and develop and increase their skills through these activities. Therefore, the establishment of authorized centers for the conferral of degrees and the development of the discipline are mutually reinforcing influences.

4. The development of a high-level teaching staff is fundamental to boosting the quality of library science education.

Students systematically acquire knowledge, develop awareness for innovation, master reasoning techniques, and build a sound moral character through frequent contact with their teachers and through a wide variety of teaching activities. Therefore, the level of scholarship and quality of teachers directly influence the quality of the students trained. Generally speaking, high-quality tutors pay the utmost attention to their guidance role and so the quality of the doctoral and master's candidates they guide will naturally also be high. Tutors must serve as models for students and should be self-disciplined so as to set a good example and practice what they advocate. Tutors are guides in the academic careers of postgraduates and their attitudes toward

teaching, scientific research, ethics, and morals all exert a subtle yet strong influence on their students. The renowned Russian educator Uschinsky once said: "When it comes to teaching, the character of educators is everything."

Postgraduates should accept the instruction and guidance of the tutor in an atmosphere of discipline. "Discipline" should first be applied by the tutors themselves through their careful and conscientious approach to teaching. They then should be strict in their expectations of the postgraduates they guide. Tutors must pay special attention to the concept of "guidance," leading the way through the maze and helping students keep on the path. They must also be patient and proficient in helping the students to learn, making use of beneficial circumstances and encouraging postgraduates to be original in their ideas and to have the courage to be pioneers. Therefore, developing a high-level and high-quality teaching staff is fundamental to fostering high-quality graduates.

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Notes from Translator

(a) The Great Leap Forward, 1958-60, was an antirightist drive followed by a militant approach toward economic development. In 1958, the Great Leap Forward campaign was launched in China under the new "General Line for Socialist Construction." The Great Leap Forward was aimed at accelerating achievement of national economic and technical development and with greater results. A detailed explanation is provided at www-chaos.umd.edu/history/prc2.html.

(b) The Cultural Revolution, 1966-76, was a mass mobilization of urban Chinese youth inaugurated by Mao Zedong, attempting to prevent the development of a bureaucratized Soviet style of communism. A detailed explanation is provided at www.encyclopedia.com/articles/03323.html.

(c) According to the classification method, second-level disciplines are branches of a first-level discipline, and third-level disciplines are branches of a second-level discipline.

Library and Information Science Education in China Today

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Abstract: *Since 1978, library and information science education has grown rapidly in China. This article sumarizes the status of undergraduate, graduate, and professional education today. It reviews significant points in education reform and describes six trends in the development of library and information science education.*

1. Development and Scale

Library and information science education in China can be divided into two stages of development. Before 1978, only Peking University and Wuhan University had established specialties in library science. Some 30–40 liberal arts students were enrolled in each of these two universities. Not only was enrollment small, but the education structure was simple: it was a kind of vocational training. The curriculum and contents were focused on document classification and cataloging. Document processing was done mainly by traditional manual methods. There were no courses on computer technology or contemporary information technology. The students found their jobs in public libraries, university libraries, or science specialty libraries.

After 1978, with the development of reform and open policies in China, library and information science education began to flourish. The scale of enrollment grew quickly. The library and information science specialty was established in many colleges and universities. Today, there are 52 library and information specialties established in universities, normal schools, technological colleges, and agricultural and medical colleges. In the last 20 years, some 30,000 undergraduate students have earned degrees in these specialties, and 50,000 students have earned professional diplomas in these areas from the Central Broadcasting and Television University or other correspondence schools.

Regular education for graduate students began after 1978. Before then, only the Department of Library and Information Science in Peking University enrolled two graduate students in two fields: library science and bibliography. In 1978, the university entrance exam was reinstated. Education at the graduate level gradually became standardized, and the number of newly enrolled students continued to grow. Several institutions can now award master's and doctoral degrees. In the last 20 years, more than 1,000 graduate students and 30 doctoral students have graduated and are working in various sectors.

2. Education Levels and Characteristics

China has an integrated education system that awards a professional degree, bachelor's degree, master's degree, and doctoral degree. In the following sections, I will introduce the characteristics of education at each level.

2.1 Undergraduate Student Education

In China, the core of library and information science education is at the undergraduate level. This is different from the situation in developed countries, where graduate education has developed on a large scale and represents the core of library and information science education. In the developed countries, students who major in library and information science typically obtain a bachelor's degree in another specialty. This kind of education suits the demands information work, which covers several knowledge fields and favors librarians and information workers who have specialized training in at least one field.

In China, however, because graduate student education did not resume until the late 1970s, the number of enrolled students was small and could not meet the demand for high-level talent. The training of qualified personnel is therefore

done mainly at the undergraduate level, and tends to focus on establishing the proper intellectual structure for teaching students the fundamentals of the profession.

Undergraduate training in library and information science is typically four years, and can be divided into three categories.

2.1.1 Comprehensive Library and Information Science Education. This kind of education developed from combining traditional library science education with courses in information science and computers. Examples include library specialties offered at Peking University and Wuhan University, and other library and information specialties established in comprehensive universities and normal colleges in 1980s. At first, only liberal arts students could be enrolled; later, natural science students were also admitted. Besides learning library science, information science, and computer applications, liberal arts students were required to learn more about the social sciences and humanities; students with a natural science background were required to learn more about technology.

2.1.2 General Scientific and Technological Information Education. General scientific and technological information education was developed in the late 1970s and early1980s. New students who were enrolled typically met the entrance requirements for natural science students at comprehensive universities, such as the Scientific and Technological Information Department of Peking University, Wuhan University, the University of Science and Technology of China, Xi'an Communications University, and Xi'an Electronic University of Science and Technology. The course content focused on three areas: natural science, the information industry, and computer applications, with special emphasis on the latter. Students were required to take jobs not only in information retrieval, programming, and system design, but also in information analysis, processing and management, and the like.

2.1.3 Technological, Agricultural, and Medical Information Education. Training in the management of technological, agricultural, and medical information began in the 1980s. It is a scientific and technological information specialty that is established mainly at science and engineering, agricultural, and medical colleges, such as Chinese Medical University, Jilin University of Technology, Nanjing University of Technology, and Nanjing Agricultural University.

The courses cover not only the information industry, computer applications, and related knowledge, but also basic subject knowledge according to the characteristics of each college and university. After graduation, students go to work in the relevant profession.

The categories just described basically cover the different categories of undergraduate library and information science education currently available in China. Although each kind of education may differ in how it allocates the course content, the curriculum arrangement basically is the same. Besides the compulsory courses, the remaining courses can be divided into three categories: library and information studies, computer applications, and related courses on specialized subjects that are offered according to the disciplinary focus and characteristics of each college and university.

2.2 Graduate Student Education

There are 13 institutions authorized to award the master's degree in library science, and 18 that are authorized to award the master's degree in information science. Three institutions are authorized to award doctoral degrees in library science, and three can award doctoral degrees in information science. In the past 20 years, these institutions have graduated a large number of highly qualified people. Graduate programs in library and information science in China can be divided into three levels: the two-year "graduate student class," master's degree graduate students, and doctoral degree graduate students. Students at each level must pass an entrance examination. Students who pursue a master's degree and doctoral degree both need to pass the dissertation defense. I will introduce each level respectively.

2.2.1 Graduate Student Certification Class. Courses in this two-year program include foreign language, philosophy, and 10 kinds of courses in specialized subjects. Students earn a graduate certificate after passing a final examination. After completion of the certificate, they can, while working, write a thesis and defend it, thereby qualifying to apply for a master's degree. Peking University and Wuhan University have this type of graduate program.

2.2.2 Master's Degree. The master's degree is a three-year program. Courses include foreign language, philosophy, and six to eight kinds of courses in specialized subjects. Guided by an advisor, students conduct research and do internships. After completing their experiments, internship, and research, students take qualifying exams and defend their dissertation. Then, after passing review at both the departmental and university levels, they receive both a post-graduate certificate and master's degree certificate.

2.2.3 Doctoral Degree. Ph.D. programs in library and information science are fairly new. The first doctoral students were enrolled in 1991. Now there are more than 20 doctoral students studying in Peking University, Wuhan University, Nanjiing University, and the Documentation and Information Center of the Chinese Academy of Sciences (DICCAS). Doctoral programs last three years. There is a supervisor and an advisory group for each doctoral student. Students need to study at least two foreign languages, philosophy, and three to four specialized courses; take part in research projects under the guidance of their supervisors; finish their doctoral dissertation; and pass rigorous examinations and the dissertation defense. Then the diploma and doctoral degree certificate applications are reviewed and approved by

the academic degree committee at the departmental and the university levels. Supervisors for doctoral students need to be carefully selected, examined, and appointed.

2.3 Professional Education

Professional education is offered both through full-time programs and through correspondence courses. The program is usually two years. Core courses include a foreign language, library science, and the information industry; in addition, full-time students need to take courses on computer applications and operations. Correspondence students mainly study on their own. The colleges and universities provide textbooks and reference books, and teachers give face-to-face instruction on the important contents and help students with problems they encounter in self-study. If students pass their examinations, they receive a professional training diploma.

3. Education Reform and Course Adjustment

The extent of reform of library and information science education is reflected by the fact that many universities have changed the name of the relevant departments. In 1992, Peking University took the lead, changing the name of the Department of Library and Information Science to the Department of Information Management—a move that had broad repercussions. As of today, 43 out of 52 departments in colleges and universities nationwide have followed suit. Some have not changed their name, but their curricula have changed.

Scholars in China have had mixed reactions to the name change. Those who insist on changing the name have the following views:

- Information management means not only managing information and its carrier, but also managing the various links in information processing, such as information production, acquisition, arrangement, storage, dissemination, and use, and providing diverse information services to all trades and professions.
- In China, library science belongs to the discipline group of information science. Traditional library science must be reformed to find an appropriate position within the developing information science discipline group. As a branch of the traditional information science field, library science must move toward information management, which is a higher-level in information science, to train professionals more broadly.
- The aim of changing the name is to enlarge the scope of traditional library and information science in accordance with developments in the curriculum and the needs of society; to broaden the scope of research and teaching; and to train students to have a more extensive scope of knowledge and adaptable abilities.

Some scholars are worried about the discipline's course of study, which they think would be influenced by the name change, but think we should maintain a dispassionate attitude during this time of social reform. Although the name is only the name, it reflects an attitude toward library and information science. The act of changing the name shows that we lack enough confidence in this discipline and related professions.

In May 1998, China's Ministry of Education issued a new bachelor's degree catalog and introduction for general colleges and universities. Information management was listed as one subject and was slated to enroll new students in 1999. In light of this, with the agreement of the Higher Education of Ministry of Education, three universities (Peking University's Department of Information Management, Wuhan University's School of Library and Information Science, and Hebei University's Department of Information Management) held a seminar in October 1988 to discuss national professional education for information management in colleges and universities. Forty-six representatives from 37 universities took part in the meeting. The aim of the meeting was to study and establish the compulsory courses for the information management major. Compulsory courses are what differentiate one discipline from another; they are the foundation for the discipline and serve as a basis for evaluation within the discipline.

After much discussion, comparison, and consultation, it was agreed that the main compulsory courses for the information management major should include the following: management science, economics, information management science, data structure and databases, information organization, information storage and retrieval, computer networking, and management information systems. At the same time, applied statistics, computer systems, and system software are also regarded as basic courses that should be listed in the teaching plan. Besides compulsory courses, there is enough room in the curriculum for each college and university to include other courses that are geared toward its particular needs or the needs of a given library and information trade.

4. Development Trends

4.1 Make Clear the Purpose of Education

With the development of specializations and the diverse demands for specialized, qualified personnel, information management departments will further define their educational aims at several levels. The aims should be practical and be reflected in the curriculum and teaching methods.

4.2 Renew and Enlarge the Curriculum Structure

As educational aims are developed and articulated, each college and university will improve, renew, and enlarge the traditional curriculum system to make the name "information management" match reality. Library science, information science, and information management should interlink, complement, and improve upon each other, not replace or totally cancel each other out. Within the broader research frame of information management, we should study and improve its theory, methods, and technology; expand its research and teaching; and make students more adaptable and competitive.

4.3 Gradually Strengthen the Curriculum System

From information acquisition, processing, storage and retrieval, service, and dissemination to information management, each link in the chain contributes to a series of connected, mutually complementary curricula which develop organically, rather than in separate parts. The basic course structure should be strengthened, especially the array of compulsory courses, which are fundamental to the curriculum system. As for computer science, management science, and such, when they are used for reference, we must take advantage of what they have to offer while eliminating the irrelevant elements.

4.4 Form Stronger Ties Between Research, Teaching and Practice

In the past, library and information science research and teaching were often divorced from practice in China. Much attention was paid to philosophical thinking when selecting research topics. So it was difficult to achieve a commonality and sense of identity among both researchers and practitioners. Information management science needs to not only strengthen and develop the academic position of library and information science, but also to develop more practical applications.

4.5 Modernize the Teaching Methods and Contents of Courses

Much attention is being paid to using computer-aided teaching, and especially to the construction of personal-computer laboratories. From document classification to information organization, from bibliographic databases to fact-based databases, from off-line retrieval to online retrieval, from traditional information retrieval systems to intelligent information retrieval systems, all can be reflected in course content over time. Information management, bibliometrics, information economics, and the like are offered also in many colleges and universities. Some programmed teaching courses, such as cataloging in Chinese and Western languages, document management, and such, have begun to use computer-aided teaching. A computerized examination question database is standardizing examinations.

4.6 Manage Professional Education Macroscopically

Recently in China, teaching reform has faced the problem of how to coordinate a centralized course system with the local course system. Because the construction of the professional course system and its quality control are becoming more and more important, regular check-ups and evaluation of library and information science education must be done systematically nationwide. Furthermore, principles of professional education must be established that will allow us to present the new face of library and information science in the new social context.

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The Transformation of Academic Libraries in the Twenty-First Century:

Challenges and Opportunities for Library and Information Science Education

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Abstract: *The paper describes some major trends in academic libraries in the United States and the implications of these trends for library and information science education. The trends relate to the profound impact of technology on libraries, the increasingly rapid pace of change, the rising expectations of library users and the competition that libraries face from other information providers, and the need for libraries to become more effective and efficient organizations. These trends are likely to generate changes in library and information science programs, ranging from increased integration among faculties and programs to greater encouragement of agility, flexibility, and risk-taking in graduates. Library school directors must be ready to restructure library and information science programs to be more open. They must also aim to train librarians who can face uncertainty and a changing environment with a willingness to be innovative.*

I am very pleased to represent the University of Pittsburgh (Pitt), one of the co-sponsors of this important conference at Wuhan University. For one thing, it allows me the opportunity to visit this fine institution of higher education for a second time. I last arrived at Wuhan with several other American library directors in 1991, having floated down the Yangtze River from Chongqing, about this time of year. Despite the dreariness of the weather, the scenery is among the most breathtaking in the world. That visit introduced me to your country, and I am pleased to say I have made a number of visits since that time; but this is my first visit back to Wuhan. I am pleased to see old friends on this campus.

But more importantly, I appreciate being allowed to represent my colleagues who are directors of academic libraries, and who, after all, are among the employers of a large percentage of your graduates. I represent the practitioners today, but I also am one of you. You see, for many of the 26 years I have directed academic libraries, I have also taught library science courses. I hold a joint appointment as professor in the School of Information Sciences at Pittsburgh. For six years, I taught the basic academic library management course there; this term I am teaching a doctoral seminar on library management issues. I also serve on dissertation committees and attend faculty meetings and even serve on some committees in the school. I have often told the dean that she got what she paid for, since they are not allowed to pay me for these services!

What I want to do today is discuss what I am experiencing as major trends of libraries today in the United States, and perhaps other parts of the world, and what these trends will mean to library and information science education programs now and in the future. I doubt that I will say anything today that you have not heard or read before.

First of all, I want to briefly discuss some of the major issues that I confront on a frequent or even continuous basis:

The Impact of Technology on Libraries

Libraries were among the first elements of universities to exploit computing. In the 1960s, libraries like Northwestern in Chicago developed computer systems to automate their circulation functions. To do this, they had to create short records of all their holdings. Then when OCLC was established in the late 1960s and early 1970s, libraries began to catalog online, and eventually that led to online catalogs. These early catalogs and circulation control systems were quite crude when compared to our integrated systems today, but they in fact changed the face of librarianship. Throughout the 1970s and 1980s, we busily automated all sorts of functions and exchanged our homegrown systems for commercial integrated systems that allowed us to order, pay for,

catalog, find, and circulate our books and serials with a single software and hardware configuration. But throughout this period, there was little fundamental change. Libraries still looked and felt pretty much the same as they had for a hundred years. We automated manual functions, but we did not rethink the basic assumptions that underlie these functions. And in automating, we did not save money as we had promised our administrations we would. In fact, costs increased as we automated.

We did not really trust or rely on our online systems either. We all had backups for everything. We had paper acquisitions files to back up our online ones and we had card catalogs or microfilm ones to back up our online catalogs. We had a few online reference and bibliographic tools to rely on, such as InfoTrac or ProQuest, but little in the way of full text articles of any kind. Most of our technology pointed patrons to our print collections and did little else.

With the advent of the 1990s, we began to realize that the application of technology in libraries might well create a revolution in the way libraries operate. In fact, it is now clear that libraries are in the midst of a transformation from a print paradigm to a digital one, and the length of the transition is shorter than we had imagined a few years ago.

If I had made this speech 10 years ago and in this speech, I had indicated that computer files would replace the book, I might have been met with skepticism bordering on hostility by librarians. Of course, any new fundamental change in technology, including the printing press or the automobile, has been met with this same resistance. Scribes protested that printed books could never replace the hand-copied book. The definition of "book" was predicated on it being hand copied; books printed with the newfangled printing presses were not really books at all, lacked authenticity and would never have the value of the finely crafted and illuminated books that they eventually replaced. But the printed book has lasted for hundreds of years as the standard for publishing, and libraries adapted to them.

A decade ago, I was among those who saw little threat to book and journal publishing in the digital world. No more. I will discuss the pace of change as a trend in and of itself, but this is certainly an area that is witnessing a quickening of the pace of development. Every time I find a logical argument that militates against the digital book or journal, technological developments overwhelm it.

The development of libraries is tied to the history of writing and publishing. Will libraries survive into a future in which the dominant form of publishing is Web-based or certainly digital in nature? Survival is not a sure thing by any means. Libraries, even academic libraries, face competition from the corporate world as well as other divisions of the universities. As "information" proliferates in electronic form, the lines that divide the library from the computer center or the distance education program or the bookstore and university presses will blur even more than they do now. Competitors will grow in number and quality, threatening the role and mission of the libraries.

Today, the number of books available online is growing. And I am not talking about things like Project Gutenberg and other early experiments with putting books online. Project Gutenberg is a very good example of a very bad idea! Typing text into computer files without proper "metadata" or accurate bibliographic information is a formula for wasting time and effort. Obviously librarians were not involved in designing or planning it.

At the University of Pittsburgh, we subscribe to a new service called netLibrary, one of the early and most legitimate efforts to publish new books digitally. Working with dozens of scholarly publishers and a growing number of what we call trade publishers, netLibrary is publishing on the Web approximately 400 new books per month. Our library is a major subscriber to this service, and we spend about $50-75,000 per year buying "access" to new books in netLibrary. Other Internet publishers are rushing into the e-book field. Libraries are buying these titles, and students and faculty are using them at a higher rate than they use the print books we buy every year. The same is true for the 6,000 scholarly journals that we get electronically, some of which we do not purchase in print.

Just think about it from a student's viewpoint. He or she can access the online catalog 24 hours a day and 7 days a week, but that is only the index to the books. If they are writing a paper at 2 a.m., which many of them do, they can identify books, but they cannot get to them until the library reopens at 8 a.m. Or what if they are completing that homework assignment and need to verify a quote they got from a book or journal article? If books and journals are accessible online, they too are available 24 x 7. And students can simply click from the online catalog directly to a book or journal instantaneously. Is this not easier than waiting and hoping to find the book or journal on the shelf? Of course it is.

But, you say, the book is better. It does not cause eyestrain to read, and you can curl up with a book in bed or read it on the train. How can you do that with an e-book? I would have agreed with you a year ago, but no longer. I have now seen the new e-book readers which allow a library or a person to purchase a book online, download it to their computer, then move it to the reader's memory and "own" it. And these readers are easy to use, they do not have cathode ray tubes that cause eyestrain, they are small and portable, and, yes, you can curl up on the beach and read books using them. What is more, in some ways, they are better than books. I have two sons who are students at the University of Pittsburgh. Their textbooks are very, very heavy. I worry about them carrying these books around in their backpacks. I worry about their backs! If they could download their textbooks to readers and just carry a small reader around, it would be better for them in every way. Our local public library has just announced that they are loaning books loaded onto what is

called "Rocket E Book" readers. Each device can hold up to 10 large books. And the navigation of a book using these readers is quite sophisticated.

I do not want to belabor this point, which to me is so obvious. My real point is that information technology moves relentlessly forward and will not be stopped because we do not like something about it. We librarians did not invent handwriting, we did not invent printing, and we did not invent the digital book. The library is an organization that historically has sought to take information sources as they existed and organize them for intelligent access and use so that new knowledge can be further developed. We are to a large degree at the mercy of whatever format knowledge is packaged into; we always have been and always will. So when we state categorically that libraries will not become digital and that our books will not become obsolete, we run the risk of being bypassed in the scholarly communication processes and systems of the future.

The Pace of Change

It is hard to separate the discussion of change in academic libraries from a discussion of technology. Perhaps this is because it is in this arena that change is most noticeable and stark.

Libraries today, at least in many parts of the world, may fairly be characterized as hybrids, caught in the transition from a print-based to a digital world. At Pittsburgh, we now have approximately 4.2 million books and 27,500 journal subscriptions. Of this number, we have purchased only 115,000 electronic books and 6,000 electronic journal subscriptions. However, two years ago, we had zero electronic books or journals that were not imbedded into other database products like ProQuest. So we have grown in the digital realm at a fast pace in a short time. While the collection is overwhelmingly print-based, and will remain so statistically for many years, our acquisitions budget is now 18 percent digital! That means that we are well along in the transition from an emphasis on purchasing print materials to purchasing digital equivalents. And we are also spending hundreds of thousands of dollars of our budget and endowment income each year to mount projects to convert retrospective, unique collections to digital collections. In one project, we have digitized more than 400 books, 600 maps, and dozens of archival finding aids related to Pittsburgh history.

As I look forward, I see the economics of publishing shifting toward the digital arena. If (I should say, when) consumers fully accept e-book readers and desire to purchase their latest textbook or novel via the Internet, the stampede to sell digital books will be on, and nothing will save the outdated book format from being relegated to the specialty marketplace. Journals will become fully digital long before books. The federal government in the United States plans to phase out its print publishing in favor of mounting documents on the Web. Journal publishers are rushing to place their print journals on the Web. We now subscribe to 6,000 electronic scholarly journals, not one of which was available five years ago. Based on what I have dealt with for the past five years, I firmly believe that the pace of change in information technology can only increase, not decrease, with dramatic and far-reaching consequences for libraries.

Since the advent of information technologies, we have lived with constant change in libraries. If you think about it, this is in stark contrast to our history as institutions. Since the earliest universities were established in Europe and America, libraries have been associated with them, and have pretty much done business in the same manner. Library science as a profession has evolved over time toward professional status and functions have changed, primarily by becoming more specialized. As libraries grew, they became complex and tasks were divided among more staff and librarians, leading to specialization. Technical services branched out into cataloging and acquisitions and serials and so forth. Public services developed bibliographic instruction from reference. But little fundamental change in the way libraries were perceived, the roles they played, or the types of workers they attracted occurred until rather recently. Administrators could be bibliophiles known for their scholarship and learning. Librarians could learn their profession and pretty much practice it until they perfected it over decades of work that changed only incrementally, if at all. Perhaps I exaggerate to make my point. But I have witnessed in my career a dramatic change in the nature of libraries. And most of that change has occurred in the past 10 years.

The pressure to change today is irresistible. Funded by taxpayers who are no longer willing to plow more and more money into higher education without accountability, we are under pressure to do more with less and to re-engineer processes and functions to free up funds internally to pursue new initiatives. This pressure is relentless today. It has followed the restructuring of businesses in the 1990s to make them more competitive globally. It worked, and today the economy of the United States is the best it has ever been in its history. Universities, too, are in competition, with one another and with new and emerging entities that seek to profit from the need to continuously retrain and retool workers in the new economy. We compete for students and for tuition and tax revenues and for research dollars. To win in this competition, we must be able to produce our "products" at relatively lower costs than the competition.

How does this play out in libraries? Well, for one thing, we must find ways to re-engineer traditional processes within our libraries so that we can find the funds to reallocate to meet new needs. At our University Library System, we have totally redesigned our technical services operation. Taking advantage of partnerships with vendors of all kinds, we lowered our staffing by 50 percent while increasing our throughput efficiency, saving a total of $1.1 million. To make a very long story very short, we absorbed a $400,000 mandated reduction in our personnel budget, and still had enough money to grow our digital library considerably over a two-year

period. This was dramatic and fundamental change. And it was very difficult to accomplish.

It was fairly easy to understand how to save money in technical services. Most of our internal processes have become inefficient over time. What was far more difficult was to manage the process of change that was required to change it. Most of our librarians and staff were not accustomed to a large amount of change, and they had never seen change that extensive actually carried out. We suffered greatly as we learned to manage that process in a humane yet effective manner. In the end, we reduced technical services by 39 positions without laying anyone off. We are not alone in doing this. Many libraries are finding that they must rethink fundamental assumptions about the nature of their services and collections often, if not continuously. The pace of change is quickening.

Rising Expectations and Competition

In academic libraries today, students and faculty approach the library with new expectations. It is no longer sufficient for us to give them what we think they should have in terms of service or collections. They want their information needs met regardless of time and space or any other consideration. If the thing exists anywhere, they want it and they want us to get it for them, preferably in electronic format, instantaneously, and delivered to their computer. They are not interested in hearing about the budget or the staffing problems or any other limitation, no matter how logical.

Almost every semester, the student newspaper at Pitt publishes an editorial demanding that the main library be open 24 hours a day. Now, we are only closed from 2 a.m. to 8 a.m. How many of our 30,000 students would come to the library between 2 a.m. and 8 a.m. on an average night? Not many. Do they care that the budget increase to be open those additional hours is about $400,000 per year? No, not in the least. It is an issue for a very few students who would actually make use of those hours, but it is constantly being pursued by the student government organization. I don't know if we will eventually be required to do it or not. But the expectation is real that we should be open whenever any one of our students wants us to be there for them.

Our faculty expect all of our important resources to be delivered electronically to their desktop computers or home computers, even though not all of the things they use are available electronically. This one amazes me. They really do not always know what is available, but assume it is available digitally if they think it ought to be. I think sometimes they believe that librarians control what is published and how it is published. I wish! And if they are teaching a doctoral student in Thailand, they fully expect that that student will be able to connect to Pitt's Web page and gain access to our 450 databases and 3,200 electronic journals.

We are victims of our success in meeting past expectations and in providing a growing array of electronic resources. We have helped create the expectation that we can provide almost anything they need. And we try hard. We have an extensive program to obtain materials from other libraries around the world quickly and easily for them. We spend more than $1.3 million dollars to provide electronic data for them. We purchase any book they ask us to buy. We have joined a consortium to build a virtual library in Pennsylvania like the OhioLINK system in Ohio. We provide 16 libraries to them so they will not be too inconvenienced in doing research in their disciplines, despite the huge overhead and duplication that it requires.

Thirty years ago, the academic library had little or no competition. Students came to us because we had the books they needed to complete assignments and write papers. Faculty used us because we either had what they wanted or could get it for them from other collections. We were the only game in town in the information business. That is no longer true. Scientists consult their colleagues and use libraries as repositories for their research. Faculty members create coursepacks at a copy center so their students do not have to use libraries to do class reading assignments. And students are more comfortable with grossly inefficient Internet search engines with names like Google and Yahoo! and Jeeves than they are with our online catalogs and library interfaces designed to meet their academic needs. If they want books to read, Barnes and Noble and other major book stores in America now provide friendly atmospheres, coffee shops on site, deep discounts, and other incentives to purchase books rather than use libraries. In fact, students can easily buy from Amazon.com and other online vendors who automatically alert them to new books they might want. (We are putting in a reading room with a coffee shop partly to emulate this atmosphere at our libraries.)

We are no longer the only information provider on our campuses. Our database vendors are looking for ways to market their information services directly to our students and faculty. Bell and Howell will sell them an express dissertation. Some vendors are developing course-related packages, available to students over the Internet for a small fee, bypassing the library altogether. netLibrary had begun to sell e-book access to individuals for a token annual fee, but the outcry from some of us and some of the economic realities of that market have stopped it for the time being. Librarians who once worked in academic libraries are now offering fee-based research consulting services to the public. This is a time of tremendous change and tremendous challenge in the information field. And now that information is a commodity that is valued in the general economy, many are flocking to provide it for profit, competing with libraries of all kinds who have seen information not as a commodity but as a right and a duty.

Organizational Development

Although there are many more trends that I could highlight, I want to end with organizational development. What do I mean? Simply, I believe that more than ever we are address-

ing issues related to how our organizations can be improved and made more effective and efficient. We directors are pouring a great deal of money and time into training staff and professional librarians. This is necessary because of the other trends I have highlighted. We are in a constantly changing environment, we face real competition, we must meet higher expectations, we work in a more complicated and high technology environment, and we must be quality service-minded if we are to be successful, and thereby supported adequately, to meet our mission to serve the teaching, research, and service missions of our universities.

In order to meet these and other challenges, our organizations must change fundamentally. Thirty years ago, a director was the boss. He or she could simply pass on decisions that would be implemented without much question. His or her authority was accepted as a matter of course. Today that is not true in our country. Good administrators are those who do not exercise their power and authority over others. The good administrators are those who lead, who build consensus, who nurture, who guide, who persuade, who are flexible and adaptable, and who can take calculated risks. Why? Because our organizations must become learning organizations, constantly growing, encouraging everyone to learn more and expand their thinking. Our libraries are organized around principles of collegiality and team approaches to issues and problems. The director is no longer seen as the idea person, who always has the answer, but instead is the person who can provide the resources for investigation and training and problem solving within the organization.

We are not managing organizations so much as we are managing change, a very different and more complicated thing to do. If we simply tell someone what to do, what action to take to resolve an issue, they may do it, but they probably will not understand why they are doing it. They may well resent our authority in forcing them to do it and they will not learn from the situation. If we help them to work with others to come up with a viable alternative to try, they will "own" that solution and will work harder to make sure that it works.

An organization cannot remain static; it must grow in size and in capacity. Our libraries must become learning centers, not only in our services, but internally as well. At Pittsburgh, we are similar to other American research libraries in devoting a growing percentage of our operating funds to learning opportunities for our staff and librarians. Several years ago, we contracted with our computer center on campus to provide us with training services. We established a training room with computers and began to schedule small classes on such things as office software and the Web. These classes have been going now for several years and continue to be oversubscribed every time. We allow only 8-10 persons in each session. We cannot offer enough of them to satisfy the need. We doubled our travel budget and allow each librarian to obtain funding for professional travel; these funds are administered by a committee of librarians. We established the librarians as a faculty so that they manage their own affairs in many respects and elect officers to govern their organization. We established 10 working groups made up of librarians and staff who are responsible for "learning" in different areas such as quality service or electronic resources or scholarly communication. We established a "behind-the-scenes" Web site for our staff that has grown to more than 1,200 Web pages with information about the work of various groups, schedules for training, etc. I could go on, but I hope you get the picture. We are working very, very hard to redefine our organization to make it more open, more democratic, more relevant, more service-oriented, and more learning-centered. I know that this is a major trend in the profession. We all seek to be more agile, more adaptable, more opportunistic, more strategic, and more resilient.

We must build change into the very fabric of our libraries. We are facing a future that is uncertain, full of threats and opportunities. The Chinese character for change symbolizes both opportunity and crisis. We are facing crises in scholarly communication systems, in funding and accountability, in competition, in many things, but all of these crises can be met only if we see them as opportunities for improvement and growth. No one relishes ambiguity and change. It is against human nature to welcome it and few of us do. But we live in a time in which we must learn to cope with it and to manage it and to mold it into creative new services and ventures.

Implications for Library Education

At this point, I want to just stop my discussion of trends. I could talk about this for a week and cover many more points. But you get the message, I hope. I do not believe that I have exaggerated the situation that I face on a daily basis. If anything, it is understated in these remarks.

But what does it have to do with what you do as professors and deans of library education programs? Everything. Your programs and those like them in my country have provided the professional talent to make libraries work for a hundred years. And one would hope that you will provide that talent for the next century.

It is common for library directors to complain long and hard about the poor quality of the graduates of Master of Library Science programs, at least in the United States. This is a tradition that has gone on for so long that I sometimes believe library science educators are now immune to our complaints. It is like the sheepherder boy who cried "Wolf! Wolf!" as a joke so much that when the real wolf came to the fields, the shepherds did not believe him, and the wolf killed the sheep. There has always been tension between those who teach and those who practice in terms of what should be taught. I have been on both sides of this issue and still have mixed feelings about it. The ideal MLS program combines a great deal of theory with a great deal of practice, I suppose. After all, theory must inform practice, but practice often informs theory as well. I want a physician who knows the the-

ory of medicine but who has spent a lot of time seeing patients and treating all kinds of diseases. I directed a college library as my first job as a librarian, but no one would want to be a surgeon's first patient on the operating table! Our medical educational system has a good balance of the two. Of course, it is much longer than our MLS programs and the tangible rewards are far larger.

These days, when I teach library management, I try hard to combine theory and practice. And the students love that aspect of my teaching. I can help them put the things they read in texts or publications into a different perspective, and more and more a historical one as well!

I am not going to try to pretend that I have answers to the questions that will be addressed in this conference. At the University of Pittsburgh, our "library school" is no longer so focused on libraries. The trend is to remove the word "library" from the names of our programs. Our school is called the School of Information Sciences. The MLIS program in library and information science is but one of the programs. There are also master's programs in information science and telecommunications, as well as undergraduate programs in I.S. and telecommunications. These are solid, excellent programs. I just wish there were more integration of these faculties and programs, but that is growing now.

As these deans will attest, libraries are viewed as just one of a number of marketplaces for graduates with MLIS degrees. As I said earlier, information and information management is now a marketable commodity in the economy. So "librarians" who are seldom given that title can get very good jobs in industry as information specialists and various other titles that do not hint at their library connections. Librarians have always been experts at organizing and retrieving information; that is now a skill that is highly valued in our society, and one that is being rewarded monetarily. But the image of librarians as reflected in the popular culture and in the tradition of the profession is a turnoff in that world, and so we are training people who will distance themselves from libraries and market their skills creatively. Obviously, since these graduates command better salaries and higher status in the world, traditional library science programs are shifting emphasis to those markets. Recruiting brochures, Web sites, and curriculum descriptions now frequently depict these other markets for graduates.

Library science education is now said to be *user-centered* and addressing "broad-based information environments that go beyond the traditional library settings." The focus is no longer on training people to go to work as catalogers or reference librarians or administrators, but on giving them broad and interdisciplinary exposure to the field of information studies. While most still go to work in libraries, the percentage who seek alternative careers is growing rapidly.

Where does this leave libraries, we might ask? Where will we find the catalogers and reference librarians and bibliographic instruction librarians and directors in the future?

Let me state categorically that I believe the trends you have heard about in this conference from my colleagues represent progress. While it is true that someone with traditional library science training and practical experience can often step in and go to work immediately with little training on the job, this is often not what we really need, and I believe that it will be less important in the future. We do offer a lot of internship and learning opportunities in our libraries for MLIS students at Pitt, and those students who want a traditional career in academic libraries are better prepared for it if they take advantage of these opportunities. But now and in the future, other characteristics are more important, at least to me as a director.

What is important in the librarians of the future? You can probably deduce from my earlier statements how I feel about this question. While technical expertise is and will continue to be important for librarians, I believe that other skills and qualities will be more important in the future. These are:

- Agility
- Flexibility
- Adaptability
- Eagerness for change and the willingness to be a change agent
- Collegiality and team orientation
- Ability to manage information processes
- An understanding of business functions
- Ability to understand user information-seeking behavior
- Ability to design interfaces and manage complex systems
- Ability to live with and thrive in an environment of ambiguity
- Eagerness for investigation/learning
- Leadership/followship
- Organizational acumen
- Ability to work independently without close supervision
- Motivation and ability to self-start
- Willingness to take risks
- User orientation
- Understanding of information ethics
- Grounding in basic tenets of the profession
- Finally, a fundamental understanding of higher education itself!

These qualities are not generally inherent in the individuals who are drawn into our educational programs. As library scientists, in the past at least, we have treated libraries as libraries, more or less the same kind of institution. This is far from reality. Libraries in research universities are quite different kinds of institutions from libraries in liberal arts colleges or community colleges or high schools. And while I know many directors of public libraries very well, the more I know about public libraries, the less similarity I see between them and university libraries. Specialization by type of library continues for me to be a valid way to differentiate careers, but certainly not the only way. Today, it is more common to see library science programs moving away from this

distinction, especially as they emphasize the information system skills that are transferable to non-library jobs.

I am afraid to argue for more emphasis on types of libraries, because I know that we cannot have all things for all people in these programs any longer, if we ever did. And if there are things that can be learned on the job easily, perhaps this kind of practical training might well be done on the job. But what cannot be learned so easily are characteristics such as agility and eagerness to continue learning throughout a long career, risk taking, and flexibility. We live in a world that is changing so rapidly that no skill set will be valid very long. We may know SGML today, but we will need XML tomorrow. We may understand online catalogs today, but we will need to understand less structured, artificial-intelligence driven systems tomorrow. We can design Web pages today, but we must design multimedia pages tomorrow. What we must have are librarians who understand that change is the only stable and unchanging reality for libraries. I have spent the past decade battling with people who came into librarianship because it was a steady, sure world in which things pretty much happened the same way year in and year out, and who now find themselves confronted with constant and never-ending change.

I have seen librarians retire rather than learn Windows! I have talked with faculty who cannot use our new Voyager online catalog because they chose not to move from a DOS-based computer environment to a Windows- or Web-based one. It is a shock to them to find us moving from the familiar comfort of a dumb terminal to a graphical system requiring them to master a mouse and the obviously impossible-to-learn "double-click!"

Conclusion

I hope that I have given you at least some sense of the future that I see for academic libraries and what that might mean for library science programs in a broad sense. Libraries, especially academic research libraries, are undergoing change of a revolutionary sort and at a pace that is quickening. We must train librarians for the future who can face uncertainty, ambiguity, and a changing environment, and who will do so with eagerness and a willingness to embrace change and take risks. We who teach these students must be willing to move outside of the boxes of the past and redefine our profession.

Directors of libraries have to meet the challenge as well. We have to be willing to articulate to you what skills and knowledge are essential to our futures. Of course, we also have to change the way we lead libraries. We must lead rather than direct. We have to provide our librarians with opportunities for growth and development and trust them and their professional judgments. It is not easy, but it is necessary for us to see our roles as envisioning the future and providing resources to allow that growth and development.

Finally, you are probably asking yourselves, what are the *deliverables* of my paper for you? What action plans do I propose to keep library science programs current? How can you as library school directors and professors make the connection between these general trends and needed changes in our educational programs? I would suggest that you can each reach your own conclusion about the implications of these trends for your programs. At least a few of these implications might be:

1. It is vitally important for all library school directors to continuously explore the broader field of information studies and to foresee as much as possible what lies ahead, and, using that insight, to restructure library and information programs to be more "open" in terms of content and structure. Management of information resources and services should be emphasized, regardless of the form or circumstance of that service. Options for tracks should be designed so that emerging trends can be incorporated, not as add-ons to programs, but as new tracks to be pursued and around which careers can be molded.
2. Just as important is the need to build into the education programs an integral component for training librarians who can face uncertainly, ambiguity, and a changing environment with eagerness and a willingness to be innovative. To do this, we all need to make changes to content, teaching methods, and faculty-student relationships, among other things.
3. I cannot tell you exactly what you should teach for the next decade, but I can say that it is very different from what has been taught in the past.

Perhaps, in closing my remarks, the one thing I can advise is: Explore, Think, and Change! Surely, if we as academic leaders, professors, and directors cannot change, our poor students will have no chance of coping with the libraries they will find in the future.

On the Objective and Implementation of Library and Information Science Education in the Digital Age

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Abstract: *The article discusses the characteristics of the library in the digital age, and concludes that the networked environment has brought both development opportunities and challenges to library and information science education. On the basis of the discussion, the author proposes objectives for library and information science education in the digital age and discusses curriculum design for realizing the objectives.*

Objectives

The library and information specialty discussed in this paper refers to the specialty that resulted from library science combining with information science programs. On the whole, specialties in library science created in our country after 1980 abide by this mode, which is often called Library and Information Science. After the specialty catalog was adjusted in 1993, the original Information Science specialty became the Scientific Information specialty. Then, in 1998, the Ministry of Education issued a new specialty catalog that combined the specialty of scientific information with those of economic information management, management information systems, information science, and forestry information management, to create an Information Management and Information System specialty. This new specialty has deviated from the scope of library and information science and has more characteristics of management science.

With the rise and widespread use of the Internet, information resources are digitized continually and are sent everywhere in the world by networks. A globally integrated, efficient information system is coming into being that is changing the pattern of information production, transfer, and use. It is providing library and information science education with unprecedented development opportunities as well as serious challenges. So we should fully consider the new characteristics of the information environment, and rethink the objectives and implementation pattern of library and information education.

Libraries in the Digital Information Environment

The Internet has created a brand new digital information environment that has had a significant impact on the role of libraries as the knowledge and information centers of society.

1. The form of libraries is changing.

With the advancement of civilization and the development of human society, knowledge has continually accumulated, documents have proliferated, and libraries have come forth to to collect books and documents, the crystallization of human wisdom. Whether the archaic bibliotheca or more modern buildings open to society, libraries are independent physical entities. In the networked environment, the knowledge and information carried by all kinds of sources can be translated into digital form and instantly transmitted around the world. On the one hand, since information resources can enter networks or databases directly, libraries no longer need to acquire them to make them accessible. On the other hand, the library can become a node or subsystem of the network, digitize its resources, and transfer them to users by network, allowing users to retrieve and use the information as needed. Readers don't need come to libraries in person, and libraries don't know who on earth their readers are. Anyone with a personal computer can expediently access the resources of libraries elsewhere in the world, and this has given rise to the term "desktop library." Such a library isn't a physical entity with fixed personnel and resources, but a dynamic "information space" occupied by numerous resources linked to each other. Users are at the center of these links, and the links are invisible to the user. Thus, the use of libraries is no longer restricted by geography. The term "virtual library," or "library

without walls," indicates that the diversified elements of the traditional library will all be endowed with entirely new meanings.

2. The library no longer has a monopoly on information resources.
Since its emergence, the library has been the center for preservation and transmittal of social documents and information. It has drawn on its rich collection to provide society with information services and has held an unquestionable monopoly on information resources. Today, however, the Internet connects libraries, publishers, individuals, organizations, and commercial companies to each other, and provides search and retrieval services for numerous resources. These resources include not only normal library materials, but also databases, electronic texts, multimedia products, and millions of human interactions. The resources of the Internet are far more abundant than those of any single library. The library is no longer the exclusive owner and provider of information resources. Corporations, computer centers, and organizations or individuals all can develop rich and colorful online services by using information resources from anywhere in the world. They can compete with libraries and information centers and thus change the means of information collection, processing, transmittal, and capture, breaking the library's monopoly on the information resource and information service markets.

3. The library's function as a medium for information services is weakening.
From its inception, the library has been the agency that has disseminated information and has traditionally served society's information communication system, in which the most important information carriers are printed materials—books, journals, and so on. After these materials are produced by authors, publishers, or news organizations, they are first disseminated to the user directly through the distribution system, or they are collected and cataloged by libraries or information centers as primary or secondary documents to be borrowed, queried, and used; that is, they are transferred to users through an intermediary. Libraries, as the bridge that connects information producers with information users, are responsible for information over time. But in the digital age, the network becomes the important medium of information storage and transmittal, and anyone can access online information directly. Direct contact and communication between information producers and users has become easier and easier. This reduces people's dependence on library and information institutions. Consequently, the agency function of library and information institutions is weakening.

4. The demands for library information are becoming more sophisticated.
Among the important functions of traditional libraries and information centers is that they collect, process, provide organization for, and maintain materials. In the digital age, society has become more diversified; people's occupations are more specialized and require more creativity. So people are no longer satisfied with the library merely as a supplier of information; they need information services aimed at answering questions and shaping planning objectives, as well as providing content. Such services ascertain users' demands on the basis of their questions and the environment, then aim to meet users' demands by analyzing and recombining information, or by helping users find the sources to answer their questions and evaluate the quality of knowledge products they provide. Such "knowledge services" support the entire process of users' inquiry, namely, capturing, analyzing, recombining, and applying knowledge. They organize dynamic and continuous services according to users' demands. Such services require that library and information professionals use their special knowledge and capabilities to analyze and process existing documents, form new information products having particular value, and answer the questions that users do not have the knowledge or ability to solve on their own. Library and information professionals therefore must participate in the users' decision making and selection process and provide expert and innovative services by combining and integrating distributed, diversified, and dynamic resources. This demands that library and information institutions not only be capable of capturing, choosing, analyzing, and using various types of information and knowledge in response to the demands of the moment, but also that they be able to design, organize, plan, and harmonize related service work and products, and provide strong, relevant, and prioritized services.

5. The object and means of library work are changing.
In the collection, processing, storage, retrieval, and transfer of documents, libraries have traditionally focused their work on printed materials and have used manual means to process them. Whether offline or online, in an age that has gone largely to computers, the work flow has not changed much, and printed materials remain the focus of the library's collection. In digital era, librarians are confronted with a great deal of online digital information and documents in many formats, which require libraries to expertly apply computer and network technology to search, verify, describe, track, link, store, retrieve, and extract the online information. These means are completely different from the handwork mode, and even differ from the systems operation mode in offline and online age.

The report, *Library 2000: Investing in a Learning Nation* (Singapore Library 2000 Review Committee 1994) identifies several important changes facing libraries in the digital environment:

From	To
Custodian of books	Service-oriented information provider
One medium	Multiple media
Own collection	Library without walls
We go to the library	The library comes to us
In good time	Just in time
In-sourcing	Out-sourcing
Local reach	Global reach

Chen Zhaozhen also lists the important changes as follows:

- Data media change from simple media to multimedia and hypermedia.
- The focus of library collecting changes from ownership to access.
- The information commons and library management system turn into an information gateway.
- Automated systems change from integrated system to a universal set linked systems.
- Databases change from distributed access to distributed storage and integrated access.
- Libraries' technology services are access services.

These important changes are bound to have a profound influence on the implementation of library and information science education.

Determining the Objectives of Library and Information Science Education

Library and information science education is advanced professional training. Professional training differs from other education modes in that it has an explicit objective: to cultivate individual capability to undertake a certain type of professional work. William McGlothlin (1960) points that the objective of advanced professional education has two aspects: to provide enough professionals to society, and to declare their professional capabilities to society. He identifies five types of professional capability:

- the knowledge and technology to satisfy social demands
- the ability to extend knowledge into society
- the aptitude for effective work
- an interest in continued research to advance professional capability
- the ability to engage in or explain research to improve human knowledge

These capabilities may be acquired through many types of education, including self-education.

As an advanced professional education, library and information science education has a special objective, although the objective may be expressed differently at different times or at different schools. One statement of the educational objectives, advanced by the Graduate School of Library and Information Science at the University of Wisconsin at Madison in the mid-1980s, is a good example:

- train professionals who are fit for every position of the library and information service profession
- contribute to the growth of knowledge in the field of library and information science
- provide services to libraries, information service institutions, and individuals

According to the standards set in 1972 for the field of library and information science, every library school must determine its educational objective. Our country also requires schools to establish specialty training objectives for the curricula.

Today, the objective of library and information education has two obvious deficiencies: one is that it is oriented to specific institutions, libraries, and information centers; the other is that it continues to focus on published scholarly information carried by printed materials. This has resulted in library and information science education being confined to a narrow space and in traditional library practice being used as the basis for organizing curricula and cultivating professionals.

After the 1970s, computers came into extensive use in every sector of library work, and they have had a great influence on traditional library practice and education. The library is no longer simply a repository of human knowledge and cultural heritage, but is also an information service center. To adapt to this change, information studies have been introduced into library research and education, and some courses on electronic information processing and retrieval have been added to the traditional curricula of the library specialty; this has infused library science with new content and vigor. So information science was listed for the first time in course catalogs as a separate entity along with traditional library science, or became listed jointly with library science as Library and Information Science.

The application of computers in library work, replacing some manual work, has improved work efficiency and increased the speed and quality of document processing. The speed of computers and the storage capacity of electronic media have given rise to many types of databases—bibliographic, fact-based, numeric, and full-text. Consequently, libraries must to go deep inside documents to organize knowledge content and information. This presents many new problems to library science and information science, and these fields will be greatly advanced by research on these problems.

When libraries began to use computers, communication technology and network technology both were undeveloped. Although the level of computer application in any single library became quite high, libraries still were detached islands of document information and their work flows did not change significantly. Although Library Science has introduced "information" into its name, the traditional basis for education and training objectives has not changed materially. Precisely because of this, library science education emphasiz-

es practice but neglects theory, attaches importance to organization but neglects a grounding in systems of thought. As early as the beginning of 1980s, the dawn of the golden age of library and information science education in China, not a few scholars criticized the lack of precision and the limitations of naming a study and specialty after the institution "library," which narrowed the meaning and scope of the curriculum and specialty development. They suggested a new abstract that would be more general to connote the processing of knowledge and information in libraries.

In fact, networks have endowed the term "library" with new connotations. In the networked environment, the library is not only a tangible entity that changes with time, place, or person; it can also be a relay point formed by a Web site in cyberspace, a stopping point for the storage and transmission of knowledge and information. Based on this understanding, the connotation of library and information science is the study of how to organize and serve knowledge and information for use. In earlier stages of economic, cultural, and technological development, society's knowledge and information were recorded on paper and stored in libraries. The organization of knowledge and information was primarily the task of libraries, which worked primarily with printed matter and designed their work flows around processing the information. The resulting specialty was named Library Science. The theories studied, whether the Entity Theory, the Arrangement Theory, or the Social Knowledge Communication Theory (Peking and Wuhan University 1991), were all established on the basis of a tangible entity—libraries.

In the digital age, the physical library has been embraced in a boundless information space, and the organization and application of knowledge and information have formed a huge industry. Besides libraries, document centers, and information centers, there are many types of corporations, computer centers, network service providers, retrieval service providers, and even individuals that can perform the same functions by virtue of the network. In such a new information environment, if we cling to the idea of physical libraries to understand infinite information space, and determine the objective of library and information science education—as well as organize and design its curricula—from the perspective of traditional library science, library and information science professionals will not only be unable to adapt to the requirements of the knowledge and information service industry in the digital age, they will also be unfit for the libraries' work.

Obviously, the objective of library and information science education needs to be reconsidered, and the name "library science" cannot truly reflect the connotation and essence of its research object. (This paper will not discuss that question.) How, then, should we orient the objective of library and information education in the digital age? According to the preceding analyses, we consider that the objective of library and information education at the undergraduate level should be to orient students to the digital information environment and to cultivate professionals for knowledge and information organization and service. And the core capability of such professionals is that they be able to expertly apply computer technology, network technology, and other related information technologies or means to capture, analyze, appraise, organize, develop, manage, and serve knowledge and information. Professionals having this core capability understand the broad spectrum of work, from document organization to information organization, then to knowledge organization and service. So they are not only capable of adapting to library work in the traditional sense, they are also competent to work with virtual libraries, digital libraries, electronic libraries, and all other types of knowledge and information organization and services that are based on networks. Undoubtedly, they are the perfect professionals in library and information science in the digital age.

Implementation of the Library and Information Science Education Objective

In the digital age, information changes much more rapidly and the rhythm of social life continues to quicken, so humans are confronted with more challenges and impacts. To adapt to the more competitive environment of modern society, countries all emphasize the quality of education, especially higher education, which has changed over time. In the 1980s, the emphasis shifted from imparting knowledge to emphasizing the cultivation of capabilities. After the mid-1990s, the emphasis shifted to all-around advancements in the integrated quality. Integrated quality includes quality in many facets, such as operation, culture, mentality, body, morality, and so on. These qualities are important to professionals in library and information science because they hold the promise for realizing the educational objectives. Among these qualities, operation quality is the foundation for professional work and is reflected by the core capabilities of professional education.

As is true in other fields of higher education, cultivating core capability in library and information science education—that is, implementing the training objective—depends on the integration and design of the curricula. And the curricula may be designed according to many theories under many rules. Because library and information science is a specialty that emphasizes application and practice, we should consider, as a group, four kinds of orientations when designing the curricula (Chen and Lin):

1. Knowledge orientation: emphasizes the knowledge system of the study; believes that knowledge noumenon is more important than cutting-edge technology; maintains that fundamental theories, method systems, and rules of practice, which don't change over time, should be emphasized in determining the curricula.
2. Capability orientation: emphasizes cultivating the capability to analyze and solve problems, and the capabilities required for professional practice.

3. Market orientation: emphasizes cultivating professionals that the job market currently demands; maintains that curriculum design should prepare students with knowledge and skills for working in special fields. The market orientation gives much consideration to the demands of the future market, but its primary focus is to design curricula that prepare students for the current job market.
4. Future orientation: aims at cultivating professionals who may be in demand in the future. In addition to considering the design and integration of curricula in a single department, it emphasizes the transverse integration of curricula among the related departments.

These orientations all aim at a certain special demand. In reality, when we design curricula, we rarely consider only one, but band together all four and then choose the best scheme to integrate them.

Because designing curricula design is complicated work that requires a great deal of human resources, material resources, and time, the following principles should be considered to avoid unnecessary losses and ensure a proper framework.

Wholeness: The curriculum design must avoid simply appending or deleting courses without regard for the underlying questions and the curriculum system as a whole. It should consider the range of influences and regard the curriculum as an integrated system with interrelated parts. Changes in any single part should consider its effect on the whole curriculum.

Systematic design: When designing the curriculum, a set of scientific design procedures should be established in advance, then followed step by step. Educators have proposed several kinds of procedures for curriculum design. For example, Taylor Rule advances the curriculum design procedure as follows (Lu and Chen):

- analyze demand (including the demands of students, society, and subject)
- set a temporary objective based on an analysis of demand
- filter the temporary objective through theories of education and learning psychology
- acquire an accurate teaching objective
- choose and organize the learning experience for students to study, and evaluate whether the educational objective is realized.

Development: The curricula must develop with changes in society, environment, knowledge, and so on. Consequently, the curricula design must be continuously researched and revised.

Full consideration of benefit to students: Curricula are implemented for the benefit of students and must support the cultivation of many aspects of students' capabilities. This includes their ability to adapt to the demands of society, their fitness for professional work, and their ability to self-educate, learn from life, stay abreast of developments in knowledge, and respond to environmental changes and competition. Any curricular framework should fully consider the level of benefit to students, and elements that don't benefit students should not be considered.

In sum, curriculum design should consider diverse factors, such as social demands, advances in technology, benefit to students, teachers' structure, subject development, knowledge system, and so on. Because it is impossible to satisfy all demands, schools should determine their objectives according to their own characteristics and design the curriculum according to those objectives.

While curriculum design must take into account the individual nature of each school, still there is a commonality to all professional education, which is determined by the age and the requirements for professionals' qualities and core capability. Considering the preceding principles and the requirements for specific qualities and core capability of library and information professionals in the digital age, we consider the following curriculum system, which can ensure the realization of the objective of library and information science education.

Group one: the general curricula or common required courses. The courses in this group must be cultivated in every higher education specialty. They are intended to lay a foundation for continued study and advancement of universal capabilities.

Group two: the specialty foundation courses. The courses in this group form the foundation for professional study and for obtaining professional core knowledge. They include introduction to library science and information science, computer principles, programming language, discrete mathematics, data structure, database systems, computer networks, operating systems, and so on.

Group three: the specialty courses. The courses in this group reflect the characteristics and core capability of the specialty and help the specialty to learn from other specialties. They include information organization, information retrieval, information analysis and forecasting, library organization and management, information services and user studies, information resource management, Internet information resource organization and utilization, the economics of information, bibliometrics, information resource development and management, Web page design and construction, and the like.

The courses listed in these categories can be regarded as the basic curricular structure of library and information science. They are the foundation that will promise realization of the specialty's objectives. In addition, several electives can be offered according to students' interest and social demands.

In the curriculum structure just described, there are only one or two courses that are directly related to the institution that is the "library." It seems that library and information science education has deviated from the library, and the connection between library education and the institution itself is becoming weaker and weaker. If we consider this question in

the traditional sense, the conclusion above should be right. But if we park libraries into the digital information environment, we find that these courses (particularly the specialty courses) can abstract, generalize, and cover the content of library work in a more general sense. And the professionals who have studied and grasped these courses are sure to be competent for the library work.

The specialty courses include many courses related to the computer which emphasize practices and are set up mainly according to the requirements of knowledge and information processing, storage, and retrieval. The proportion of the curriculum devoted to these courses should be less than that in the computer science specialty. The computer application courses are the foundations for students to continue studying other specialty courses, and, at the same time, they are the important means for students to be competent in information organization and service in the networked environment. In the past, there have been many disputes over the quantity and proportion of computer courses. Some scholars believed that graduates in library and information science should not be required to grasp systemic computer knowledge, but, rather, only the instruction and operation of the system interface and to provide users with information services by using the existing databases or online information systems. With the continuous digitization and latticing of the information environment, this viewpoint becomes less and less tenable. In the networked environment, anyone who does not have systemic knowledge of computer applications and network applications can play only a minor role in library and information work, not to mention the larger information service industry. Without question, computer professionals are able to do the system development and maintenance work in library and information institutions, but it takes a long time for graduates in the computer specialty to become familiar with information organization and processing work. The experience of many information service institutions has proved that it is not ideal for computer professionals to undertake the organization and development of information resources, because they lack the core capabilities of library and information professionals.

This paper only discusses the objective and implementation of library and information science education at the undergraduate level. In fact, there are diverse and mutilayered demands on library and information science in the digital age. To undertake knowledge service, professionals need training at several levels, including double degrees, master's degrees, or doctoral degrees. And students from different specialties need to be cultivated and trained in the core capabilities of library and information science. Then they will be competent for the different kinds of work in the future knowledge and information service industry.

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New Developments in Graduate Education in Library and Information Science in the United States:

Formats and Technologies for Offering Distance Education Courseware

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Abstract: *Distance education has moved from offering a few courses within a single university to the provision of complete degree programs and access to other courses from other universities. The rush to meet the challenge of offering distance education opportunities finds library educators in the United States developing courses using a variety of formats and technologies. Deans and directors are faced with many problems of curriculum and content. Such major obstacles arise in providing time and assistance to faculty who may or may not wish to change their teaching plans while other faculty think they are adapting courses with little understanding of the instructional design process. Some U.S. schools are exploring consortia arrangements to buy or lease courses.*

In this paper, models for today's distance education point to the need for instructional technology experts to help in the design of courseware. A synthesis of the research into best practices points out success and avenues for improvement. Challenges to offering this type of instruction are discussed. Lessons learned from students taking classes and instructors teaching recent courses using Web-assisted instruction include determining who owns the courses being developed, the problem of copyright of course content, and payment for intellectual property rights. Some remaining questions lead to suggestions for further research. These all pose interesting, new challenges to overcome. Finally, suggestions are made for ways that will encourage library educators around the globe to share their expertise and expand distance education internationally.

Introduction

One could argue that distance education began when the first person borrowed the first clay tablet from the first collection of clay tablets, took it away to another location, and, using this medium, learned new information. Roving storytellers carried news from village to village teaching solutions to problems from one group to another. In China, paper was created and the invention of the printing press made it possible for more people to have access to information that could be taken away and studied in their own time and space. Most recently, distance education has been defined as "A method of instruction and learning designed to overcome barriers of time and space by allowing students to study in their own homes or at local facilities, often at their own convenience, using materials available electronically or by mail" (Reitz 1996).

With the development and widespread use of the Internet, distance education is no longer an opportunity for a few. The challenge for institutions of higher education is to convince faculty to prepare courses and expand degree programs onto the Internet.

Distance education replaces what is currently defined as "traditional" education, where teachers stand in front of the classroom filled with students. In traditional education, while research assignments take students to other locations for completion, most of the information transmission occurs in a room with a touchable teacher facing a live audience. When education becomes distant, students receive an education while living in geographically dispersed areas. If the program is well designed, it remains high quality. Yet, some ask whether this truly represents a new method of teaching. "The vast majority of online courses are organized much like their campus counterparts: developed by individual faculty members, with some support from the [instructional technology] IT staff, and offered within a semester or quarter framework. Most follow traditional academic practices ("Here's the syllabus, go off and read or do research, come back and discuss."), and most are evaluated using traditional student satisfaction methods" (Heterick and Twigg 2000). Some changes may occur when additional resources, human and material, are added to the course.

With emerging patterns of distance education, qualified personnel who are located at other sites may provide expertise that would not be possible for students to find on a single campus. Virtual collections of resources are developed and become available to students in the class, thereby widening access to information. As distance education grows, different delivery formats are designed; and, while built on the past, changes come as student needs change. Delivery has moved through three levels.

Authors have coined the phrase, "first level learning," as evidenced by development of correspondence courses and "second level learning" as multi-media resources. "Third level" learning relies heavily on newer technologies such as interactive television transmission (ITT) and Web-based or Web-assisted instruction. Within each model, varying levels of opportunities arise.

In earlier days, correspondence courses offered the option of sending the course outline and assignments to the student with student's responses returned for correcting and assessing progress. This was a slow process depending upon mail delivery as well as student time to complete the assignments and teacher time to review and return comments. While telephone and two-way radio transmission made it possible to have conversations with the instructor, interaction with other students was difficult because of their isolation from one another.

The development of audiovisual resources to supplement printed information greatly increased the ability to provide instructional materials for students. Audiotaped lectures gave students something to listen to as well as materials to read. Transmitting televised classes on videotape provided an opportunity to see lectures and demonstrations. Yet, the situation remained the instructor providing the information and students as audience. Whether or not a student understood the content was judged purely on the answers given to any homework or test questions. In some situations, a person was not usually involved in course design and was not expected to provide any assessment of student performance. Verbal communication remained one-way until the development of interactive television transmission and computer interface to the Internet.

Models for Today's Distance Learning

Today's models for distance learning include the ever-widening use of multimedia resources. Learning in cyberspace requires only a computer, modem, and telephone or satellite or radio. The School of Library and Information Science (SLIS) at San Jose State University (SJSU) has been using interactive television for almost ten years. Some consider interactive television offering content over network wires or high quality satellite transmission to be less useful now that the World Wide Web (WWW) is available. Relying totally on Internet connections will become more useful as videostreaming improves, and that improvement continues steadily. At present, students must have a high-speed modem for smooth transmission for video streaming.

While there are differences among the media that can be used to provide instruction, the discussion that follows provides a general introduction of several formats used with different modes. Within the format of ITT, different models exist for providing instruction: instructors may remain at one site and transmit to one or more sites from that location. An instructor may travel among the sites and transmit back to the original site throughout the course. Instructors may be located at each site during transmission, a form of a team-teaching model from the traditional classroom. An instructor at one site may use mentors at each distance site to answer questions and lead discussions. One of the strengths of ITT is that each class may be recorded and the tape made available for review at a later time. While instructors may use the Internet to communicate with students in all classes, traditional or transmitted, the Internet provides distance students an easier, less costly, and more rapid way to contact class members as well as teacher. Through chat rooms and discussion groups, students keep their sense of community and shared learning.

Adding e-mail and Web components provides additional options for ITT. Interactive video classes may meet less often with additional information placed on a class discussion list, on a Web site, or CD-ROM. All other interactions between students and instructor including discussion among students exist through these alternatives to meeting in a classroom.

Distance programs may combine campus visits with other formats. Students arrive on campus to meet their cohort group, attend orientation and one or more classes, and then return home. These programs combine face-to-face interactions with Web-assisted instruction. The differences exist only between the length of time for the campus visit and the number of repeat visits to campus. Students may or may not visit the home campus, attending off-site with a downlink into their distance classroom or their desktop at home. Reception is available through Cuseeme or a television set.

Chris Dede reports several methodologies using multimedia (Dede 1996). In one project, desktop video teleconferences, joint software environments for remote, real-time collaboration, access to the Internet, and a multimedia notebook with embedded templates are used for sharing ideas. Scientific visualization software completes the array of tools. In another project, "teaching teleapprenticeships" permit bachelor's level teacher education students to interact with Internet-based resources, practicing teachers, and mentoring K-12 apprentices from their classrooms. Teachers in another setting conduct field-based experiences with students linked by shared data and collaborative discussion using notebook-sized computers, pen-based interfaces, wireless networking, and customized software. These seem to imply mostly Web-based experiences.

Purely Web-based classes mean that all content is on the Web. The only communication is through electronic mail in-

teraction. Students "talk" to their instructor and with each other through chat rooms and discussion groups. Group projects are carried out as online exercises with students never meeting each other. Preparing the courseware to make these options learning experiences requires careful instructional design.

Instructional Design

Faculty members who think it is a simple task to convert lecture notes into an online course have missed a critical element, the instructional design process. Whittington concludes that effective instructional design and techniques are crucial elements in student achievement (Whittington 1987). Factored into instructional design for distance classes is the need for adequate hardware and software for both instructor and student. Those who create such courses must recognize the challenges of equipment and students' personal lives and learning styles. Some faculty will need help from instructional designers to transform their classroom techniques into online opportunities.

Instructional designers have begun to address the differences between designing instruction and providing a platform where learners can quickly become autonomous. Distance learners must take full responsibility for their own learning, from coping with technologies involved to setting their own study time, providing for distractions of family and work, and the lack of human intervention and interaction in a social environment. Harasim and others describe a set of learning approaches in the design of learning networks (Harasim et al. 1995). These include *electors*, the presentation of electronic lectures; asking an expert to respond to questions; mentoring a professional in a particular subject to help a student; tutor support; access to online databases; informal peer interactions; and structured group activities. They further recommend using online seminars, small group discussion, learning partnerships of students in grouped pairs, learning circles, and team presentations of teaching by learners as well as online debates. One way to share such strategies and to introduce faculty who want to revise their classes using instructional design principles is to give instructions to small groups of teachers.

An institute held at SJSU in January 2000 provided participants with the opportunity to recreate their traditional courses as online instruction for students. This ten-day intensive experience offered assistance in preparing a continuing education course that would be implemented, tested, and reviewed after six months. Participants were introduced to commercial programs that would help them design their courses quickly without having to learn more sophisticated applications such as html tagging. They were given the copyright restrictions to the use of materials to be placed on a Web site. Instructors were onsite during the entire program, immediately accessible when problems arose. Participants returned to their homes to implement their courses.

Six months later, participants met again to share the successes and problems that appeared as they began to teach online. They also brought their plans for a second online course, and these were discussed. At both the institute and the follow-up session, participants critiqued each other's courses to suggest improvements and to correct flaws.

Other Challenges

Many challenges cited in the literature, as well as others experienced by this author, stand in the way of providing distance education. Among them are the lack of good transmission, training students to participate in this new environment, and ensuring that students have access to hardware and software. Keeping course offerings at a high level that match on-campus traditional courses requires care in planning and execution. Lack of a reliable network challenges the delivery of ITT.

Face-to-face interaction between instructor and student, even through interactive video, may be hampered by technology failure, fear of appearing stupid, being shy, or time constraints (Kelsey 2000). In 1998-1999, two veteran SJSU SLIS instructors refused to continue video teaching in the 15-week, 3-hour session because of the uncertainty of network delivery. Network crashes, signalled by a frozen screen that fills with a mosaic of colored shapes, bring groans from students.

Learning to communicate with the instructor from a distant site poses another challenge. Students may need to learn how to attract the teacher's attention. In some classrooms, a student speaks and the camera moves to that spot. In others, students must push a button to speak and the camera must be moved manually to that seat.

When the instructor cannot easily see everyone, it is more difficult to ensure that students participate in an interactive classroom. Shy students may choose to sit in a seat that hides them from the camera, and any movement of the camera, either manually by technician or automatically when a microphone opens, easily misses them. One instructor told the author that it was difficult to get the off-site technician to show the entire classroom after the first break, and students would leave the class unnoticed. Time constraints also limit the number of questions that can be posed and answered.

"Classroom behavior" becomes a challenge when the instructor is not in the classroom and only one of the remote classrooms is displayed on the screen. Students may be unaware that the camera is turned on in their classroom. Because it is easier to let attention wander or to think that they are unobserved, they may appear rude to a student speaking on camera in another location.

The deterrents to participating in Web-based continuing professional education as reported by Perdue and Valentine reflect similar concerns for degree programs: concerns about communication, quality of course offerings, access to technology-related resources and the availability of necessary personal resources (Perdue and Valentine 2000). They may

lack the ability to download the necessary software or lack reliable access to the Internet. They may not have or want to purchase the computer hardware, and they may lack confidence to participate in this type of instruction. Lessons learned from the SJSU institute and in the literature follow.

Lessons Learned and Questions Remaining

Educators plan classroom experiences to help students learn. Transforming these plans for the variety of environments in which learners learn away from the instructor is a different challenge. The question remains, "Do students perform as well or better than those in traditional classrooms?" Research reports from other disciplines as well as library and information science begin to answer this question.

From the Student's Point of View

Under the leadership of Stuart A. Sutton, the SLIS at SJSU began to offer distance classes as a test to see whether a statewide program in library and information science would be possible (Sutton 1996). The LIS program at the University of California at Berkeley closed and the University of California at Los Angeles, continuing its full-time program, was moved into the School of Education and Information Studies, thus creating a need for an expanded program at SJSU. The first offering through interactive video instruction was tested to determine the level of success.

In this study of interactive video instruction in library and information science, Stanford compared the use of asynchronous transfer mode (ATM) technology at SJSU to California State University Fullerton (FLRTN) (Stanford 1997). Some classes were taught in the traditional format of three-hour sessions over 15 weeks, others in a different mode. Students at both locations had positive reactions to sites and comfort level, though the sense of community seemed to be lost. There were significant differences in instructors, perceived learning, and reliability of the technology. Overall, the distance experience was not considered that much different from the traditional classroom if the instructor was good. Stanford pointed out that issues to be considered by those developing courses include reliable online syllabi, allowing for cooperative work among students, use of e-mail for advising and evaluating work, and good materials.

Although the initial test of ATM technology was mostly positive, other units of the university system continued to use Codec transmission, and the SLIS returned to the university network. Replication of this original study has not been possible because of the shift in quality of transmission. Recent improvements in network transmission would encourage a replication in the immediate future.

Two less formal evaluations have been made. For the first, Dowlin tested three modes of teaching a single course in 1998-1999 (Dowlin 2000). One was taught with three-hour classes over fifteen weeks, the second with six eight-hour days over eight weeks, and the third class was taught by interactive television transmission with two students receiving their instruction in their homes. All students could communicate with the instructor by e-mail and telephone during the class sessions. The instructor found no difference in the quality of student papers.

Navarro and Shoemaker reported the results of a study of undergraduates in an introductory economics class (Navarro and Shoemaker 2000). The study compared the performance of cyberlearners (one class meeting at the beginning of the term followed by CD-ROM lectures, electronic testing, electronic bulletin boards, and online discussion groups) with that of traditional learners (weekly three-hour lectures with one-hour discussions). Results suggest that cyberlearners learn as well as, or better than, traditional learners and those who succeed do so with "a high degree of 'learner satisfaction'" (Navarro and Shoemaker 2000, 29).

Computer-mediated communication (CMC) was the topic of a study by Vrasidas and McIsaac (Vrasidas and McIsacc 1999). Interaction between teachers and students and among students themselves remains a key component of both teaching and learning. When instruction moves from the classroom to the online environment, opportunities for interaction increase. Time constraints disappear, and students formulate their responses without the pressure of answering an instructor's question or participating in directed discussion in the classroom. With CMC, four factors influenced interaction: structure, class size, feedback, and prior experience. Structuring activities for the class increased communication. However, classes of fewer than10 students seemed to pose problems if one or more students chose not to participate (although one reason given for failure to participate was the heavy load of coursework required). Feedback from the instructor and from other students, while related to class size, affected perceived success. Students new to CMC were reluctant to participate in this form of interaction. Barreau pointed out that maximum student interaction helps in distance environments, but students may choose to ignore their e-mail messages when they would have more difficulty ignoring face-to-face communication (Barreau 2000).

In the summer of 2000, a core course, Library and Society, was transmitted from San Jose to three other locations in the California State University System—Fullerton, Sacramento, and San Francisco—over four weeks. The first meeting on Friday evening and the second on Saturday afternoon were four hours. The third class was an eight-hour day on Friday. The instructor transmitted the first two classes from San Jose and traveled to Fullerton for the third session. At the close of the final session, students were asked to respond to six questions about the class (Woolls 2000).

Students and instructors said that they wished they could see the other classrooms all the time. Bandwidth constraints limit the number of sites that can be visible at once to two, the instructor's site and one other. When no student activated a microphone at a different site, the camera usually remained on the last site from which a student spoke. One stu-

dent did not feel any loss of socialization and commented, "I don't talk to everyone usually because classes are big. Smaller groups make it easier to get to know people." Another said, "Socializing with students in other locations is a challenge. If it weren't for these distance classes on video, we would *never* come in contact with students in San Jose, Sacramento, and San Francisco." One student wrote, "I found it inspirational and motivational to be able to read others' work. This was probably the aspect of the class I appreciated most since I've never had that opportunity before. In this way, the class seemed very advanced and yet very human, a rare combination."

Small completed a study of part-time resident students who commute to traditional classroom courses at Syracuse University with distance learning students who come to campus only briefly and communicate with staff and instructors by telephone and e-mail (Small 1999). Their program, MLIS Independent Study Degree Program (MLS-ISDP) is open only to students who are enrolled in that program. Students begin with a summer introductory course and return to campus in the fall, having completed independent assignments in which they interact with instructors.

In a recent study of the distance learning option at the University of Illinois, Kazmer queried students in the LEEP program (Kazmer 2000). With the exception of a two-week introduction to the program and one visit each semester, all other instruction employs a variety of computer technologies with which students can communicate with their instructor and other members of the class. Reporting the results of a series of interviews that revealed student's perspectives on coping with planning, technology, workload, social issues, integrating life and school, administrative adaptation, and efforts and rewards, the author made several suggestions.

In concert with the Stanford study, Kazmer reported that students want syllabi for their courses; however, LEEP students want it well before the course begins. This may reflect the difference between Web-based and transmitted courses. Kazmer reported that students need technology training long before classes begin and that "both students and instructors/administrators need to think carefully about the technology that is available to them and use it wisely" (Kazmer 2000). One student in the summer SJSU course reported, "Technology was not compatible with levels of software on my home computer, but I did not know at first *what* the problem was." Kazmer's students wanted "familiar individuals who can provide timely and reliable technology support." One SJSU student was dismayed when "I struggled at first without knowing I could get support from the lab on the SJSU campus."

Both Kazmer and Small found that interpersonal relationships were formed during the residency and were continued during the semester by e-mail. Distance students appreciate being able to read e-mail or conduct electronic discussions according to their own schedules.

From the Instructor's Point of View

In assessing the instructor's point of view, two topics are of interest. The first relates to the need for any professor to understand whether students are actually accomplishing, learning, thinking critically and applying what they learn to other situations. In other words, are they becoming educated? Machtmes and Asher offer a meta-analysis of the effectiveness of telecourses based on learning achievement or test scores, learner attitudes toward their instruction, and attitudes toward both content and instructor (Machtmes and Asher 2000). They point out that the improvement in delivery methods has provided new ways for students to communicate with their instructors. When classes are recorded on videotape, there is the added advantage that they can be reviewed at another time. The authors concluded that there did not appear to be a difference in achievement between distance and traditional learners. Of ten instructional features, only three had an impact on achievement: interaction during broadcast, type of course, and type of remote site. However, the authors caution that additional study is needed as delivery systems change.

All the reports in the literature, research-based and anecdotal, seem to show that it takes more work for an instructor to prepare and teach a course for distance learners. According to a recent report in *The New York Times*, instructors are doing this because it is "new, different, and fun" (Weiner 2000). It also provides them with flexibility. Faculty members experience a sizable increase in e-mail messages because all students, the shy and the aggressive, respond. One faculty member at SJSU finally set "virtual office hours" so students did not anticipate an immediate response to a 3:00 a.m. posting of a message.

Small listed instructor needs as more time to prepare, activities that required minimal resources for students, regular feedback, group work techniques, online lecture and interactive discussion, timely feedback, and continuous assessment of student learning. Instructors noted that they are devoting more time to advising students.

Small also reported the need for different university library policies and cooperation with public libraries to serve student needs. LEEP students at the University of Illinois have been pleased with the programs from their library and bookstore that allow them to have fast turn-around for requests. At SJSU, faculty members are working to create a virtual library for students so they have sufficient resources online to complete most assignments. The isolation of some students requires a three- or more hour drive to the nearest library with enough research resources to help them.

From the Institution's Point of View: Management, Ownership, and Costs

Altering the fixed length of classes, offering courses in something other than the traditional format, determining what tuition to charge, and applying "in-class attendance" hours all challenge the bureaucratic procedures of universities; and

the larger the nigher education setting, the more difficult it is to change.

Because SJSU is one institution in a 23-campus system, any change must be presented not only on its campus, but also to the chancellor's office. Each campus has a continuing education structure to work out solutions, but there is not consistency among these offices on other campuses. Such bureaucracies pose problems in trying to build and expand a distance program before addressing who owns a course.

Faculty members who create online courses alone are most interested in who owns the courses developed for teaching in a distance format. Many institutions are claiming ownership because such courses are developed using university equipment and teaching time. In some locations, the course, once placed in the distance format, no longer belongs to the faculty member. In others, the ownership remains the property of the instructor.

In discussing the possibility of one institution marketing its courses for use by another institution, creators of the courses are concerned not only about their course being used without their receiving any remuneration for the use, but also about the chance that another faculty member could make alterations in the course, thereby destroying the integrity of the originator. Faculty members are therefore reluctant to design distance courses that will be marketed. It has not been shown that these courses provide more than cost recovery.

What combinations of costs and enrollment levels for distance courses are cost competitive with classroom courses when a large percentage of instruction is provided via distance courses? In *The Journal of Distance Education*, Frank Jewett describes one pattern including ". . . a substantial start-up, or fixed, cost that is independent of enrollment (studio communication, materials preparation, and network costs) plus a variable cost that depends on the actual number of students enrolled (primarily interaction and evaluation costs)" (Jewett 2000).

This simulation of an evaluation model is still being developed, but it offers suggestions for costing television or broadcast courses, asynchronomous network courses, and course sharing. The Jewett article contains Web addresses for eight sites with the formulas used to analyze the actual costs of preparing the courses. Cost will be a factor in the development of global distance education.

Possibilities for the Future, a Global Perspective

Because educational programs are no longer confined by time or distance, we should acknowledge challenges in addition to those previously noted. An obvious challenge is the availability of technology for the learner, a problem that exists in the United States and might be an even greater challenge elsewhere. Cultural differences and the barrier of language combine with uncertainty about appropriate examples for students to share.

Nonetheless, each new technological advance seems to erode those differences. As language processors begin to translate the symbols we use to create our words, phrases, and sentences into another's language, we can communicate. It seems that transmitting information over the Internet is not as much of a problem as it once was.

At a recent lecture, John Perry Barlow described his work with Maori tribesmen who were Internet users (Barlow 2000). They were not dismayed by their lack of electricity. A shed full of old truck batteries and a regular visit by someone with a generator to recharge these batteries allowed them to access the Internet from communication satellites high in the heavens.

This, then, brings us to content and curriculum. Determining a common core for students remains a high priority for designing library education in the United States and for those schools that wish to be accredited by the American Library Association's Committee on Accreditation. We are asked to make sure that our students have a solid foundation on which to build their advanced courses. To create a common core between international sites requires faculty to understand what is being taught in both countries or on both continents. This means communication, and that communication link is available now on the Internet.

With the rapid changes in technology, we will soon have capabilities beyond our wildest imaginings. We must use our imaginations to make links between us as library educators. Language is not a major barrier in many library schools in the United States because they have international faculty members; SJSU alone has three professors who speak Chinese fluently. One is a graduate of Wuhan University. It is they who have translated my PowerPoint slides for this paper. They may serve as the bridge to others on our faculty and to other faculty members in schools of library and information science in both the United States and the People's Republic of China.

Visiting scholars also increase communication. Sharing course outlines to find the similarities can begin the process or finding common curriculum points. Perhaps one of the outcomes of this symposium will be to let us, working together, plan these and other steps to continue sharing information and helping educate our students over distance and time, beyond language and culture, time and place.

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Some Reflections on Library Education in China

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Abstract: *This paper examines the changing marketplace of the new economy and its impact on library education in the United States and China. Digital library development will permanently change the ways libraries operate. This reality requires library educators to reform and redesign the curricula of library science programs. In the midst of the new economy, China needs more librarians and libraries than dot.com startups. Preservation and further development of library science education in a core liberal arts and science tradition are essential in China despite the burgeoning development of a knowledge-based information industry. The paper compares the library education system in the United States with that in China.*

The digital revolution in the twenty-first century has profoundly changed the ways libraries operate. With the formation of the global economy, a knowledge-based information industry is replacing the traditional manufacturing economy as the leading economy of the new century. From the developments in the United States in the past decade, it is evident that the digital revolution has had a powerful impact on every aspect of human life, and has changed the ways we communicate, interact, and conduct business with each other. To give one example, e-commerce has revolutionized the old modes and methods of commerce and trade, which has duly led to the formation of a virtual global market with no borders. In this model of transaction and communication, information is transmitted instantly through the vast cyberspace to all corners of the globe. We now see the same change being duplicated in libraries across the United States and in other parts of the world.

The Changing Marketplace

Library schools are undergoing far-reaching transformations and are increasingly geared up for the changing marketplace today. Basic rules of supply and demand dictate that library education in China, as everywhere else, must undergo reform and adjustment so that it can train sufficient and qualified information specialists for the new marketplace. In this connection, I would like to list the following changes as indicators of a changing marketplace.

1. The ubiquitous nature of electronic publications: Electronic publishing is gradually taking the place of traditional publications and has in many instances deprived the library of its traditional role as owner of information. In this changed environment, the library can provide information through site licenses, without archival and physical storage of those information resources. Under this new model, the library is becoming an information provider and broker, rather than a warehouse of books and journals.
2. Electronic publications as substitute for the print collection: In some fields, such as engineering, science, business, and medicine, electronic publications have the potential to replace the entire print collection. Today, electronic journals are already replacing print journals in many fields. In those fields, knowledge is updated more frequently than in others. Consequently, researchers in those fields rely less on retrospective information, which we typically find in traditional library collections.
3. Discrepancy of dependency on the library as a result of the digital media: Because of the widespread use of the Internet and the development of an information industry, researchers in certain fields can rely exclusively on the Internet to conduct their research in lieu of a traditional library, whereas researchers in the humanities and social sciences continue to use the library as their primary source of information. This discrepancy of reliance cuts across academic disciplines.

4. The emergence of a global digital library: Electronic networking has significantly shrunk time and space, and a global digital library is being developed to connect collections and information resources throughout the world. This digital revolution has changed the ways of library operation. Web-based information service is taking center stage in libraries in North America, Europe, and some parts of Asia. Integrated information systems allow users to access major library information services such as circulation, reference, and literature searching from a single computer interface. Library services become just-in-time and ubiquitous, resulting in great improvements and efficiencies in the gathering and dissemination of information.
5. Commercialized information services: With the development of an information society, commercial companies are becoming the major players in Internet-based information provision and service. Those areas are traditionally library business. Information has increasingly become a commodity. As a matter of fact, the entire human race is now getting involved in building up a boundless global library of knowledge and information. This global virtual library is run by for-profit and non-profit organizations alike, and by libraries, government, and research institutions as well. It is one of the most striking characteristics of the information society. For example, the famous Yahoo, Inc. actually performs the library function of cataloging, indexing, and reference for various information resources, and AmericaOnline, Inc. similarly performs the library function of providing access for information and entertainment seekers. netLibrary is also taking up the function of a library circulation department, all within this vast and boundless global library.
6. Libraries as publishers: A new trend in the digital age is that libraries are becoming publishers, in addition to their traditional role as information providers and stewards of knowledge. Scholarly publishing in cyberspace by libraries has been a deterrent to the skyrocketing pricing of academic journals in recent years and has improved scholarly communication and the dissemination of new knowledge. This trend is well documented in the literature (e.g., Cummings et al. 1992).

Library educators need to be aware that libraries in the twenty-first century will be fundamentally different from those in the past. As a result, today's librarians will be tomorrow's information managers.

Digital Library Development and Its Implications for Library Education

Libraries will continue to exist as institutions of knowledge, learning, research, and education. Libraries will be increasingly digital. We can find a definition of the digital library in Arms (1997). "An organized collection of multimedia data with information management methods that represent the data as information and knowledge." From this definition, we see how drastically different libraries of the future will be from those of the past. The Digital Libraries Initiative (DLI) took shape in the United States in the late 1980s with discussions between researchers and agencies such as National Science Foundation (NSF), Defense Advanced Research Projects Agency (DARPA), and National Aeronautics and Space Administration (NASA). These agencies then funded six DLI projects in late 1993 and, since then, interest and activities related to digital libraries have accelerated rapidly (Griffin 1998). Based on the recognized achievements of the DLI and the promise of additional federal investment in digital libraries, a follow-up program was announced in the spring of 1998. In this new program, "Digital Libraries Initiative–Phase 2," NSF, DARPA and NASA are being joined by the National Library of Medicine, the Library of Congress, and National Endowment for the Humanities as primary sponsors. As Griffin points out, "digital libraries are meant to provide intellectual access to distributed stores of information by creating information environments which advance access beyond electronic access to raw data—the bits—to the fuller knowledge and meaning contained in digital collections." With the rapid development of digital libraries, traditional libraries are undergoing a rebirth.

The new library will operate under a completely new model as discussed in Zhou (1999); namely, it will allow users to access information resources stored not only in a given library, but also elsewhere through structured search and delivery mechanisms. Document delivery technology will allow not only the browsing of published information, but also ownership of such information by individual users whenever copyright provisions permit. In this regard, librarians will become knowledge and information navigators for users in their quest for information. Such an operating environment will naturally require information specialists to be equipped with special training, knowledge, and skills in addition to what is required by traditional librarianship. Knowledge of information systems, computer technology, and database management will be essential.

Digital libraries are undergoing rapid development in the Chinese-speaking world as well. Those developments are changing the faces of libraries in Mainland China, Taiwan and Hong Kong. In the 1980s, the Commercial Press in Taiwan reprinted the collectanea of canonical scholarly works *Wenyuange Siku Quanshu* in 1,500 volumes. Then, it would have taken a big truck to move this set. Ten years later, the Chinese University of Hong Kong Press republished the set in digital format. The digital edition contains more than 100 CD-ROMs, which can be carried away in a totebag. Throughout the history of China, famous scholars earned their reputation by being able to memorize and identify the sources and *locus classicus* of citations from the Chinese classics. Thanks to information technology, we now have electronic databases of huge classical Chinese scholarly texts such as the *Twenty-five Dynastic Histories* and Thirteen Classics. Re-

searchers today can cite and verify sources of scholarly citations easily by searching those databases within seconds. In recent years, we have seen electronic publishing of full-text Chinese academic journals in China. For example, Tsinghua Tongfang, Inc. has produced a WWW-based full text Chinese journal database—*Chinese Journal Net* (CJN). This database contains more than 6,000 Chinese academic journals in full-text, with full text markup and search engines. Those resources speak volumes for the burgeoning digital library development in the Chinese-speaking world.

Also in recent years, there have been efforts to build up a Chinese global digital library by linking up Chinese library collections and information resources throughout the world. In 1998, the first working meeting on creating such a Chinese global digital library was held in Hong Kong. In June 2000, the second working meeting was held in the National Library of China in Beijing. Participants of those meetings included library leaders and scholars from all over China, Taiwan, Hong Kong, Singapore, North America, and Europe. The purpose of the meetings was to discuss global cooperation in Chinese digital library development. Meeting participants have identified some immediate tasks, including the creation of a large amount of content material and the establishment of metadata standards.

China launched an initiative to establish the Chinese Academic Library Information System (CALIS) in the late 1990s as a national bibliographic database for resource sharing. This database is dubbed the future OCLC or RLIN of China. It is an important step in infrastructure development in this country. These developments will pose specific challenges to as well as opportunities in the education and training of future librarians and information professionals in this country. Having pointed out those encouraging advancements, I would like to briefly mention some existing barriers to the establishment of a global Chinese digital library, including different coding systems of Chinese characters and different metadata standards. Those problems need to be solved.

Library Education in China

Ever since Mary Elizabeth Wood, an American missionary and librarian, established the first library school in China some eighty years ago, library education in this country has been successful. Though limited in number, Chinese library schools turn out many excellent librarians who in turn have helped with the advancement of Chinese society in many significant ways—participating in the fight against illiteracy and opening up the country to science and technology from the West, to name just a few. The establishment of Western-style library schools and libraries also opened the door for the general public to the vast number of library collections. This is perhaps the most significant contribution of China's library education to Chinese society because, for more than a thousand years, libraries had existed in China only as storage places for books belonging to the elite and literati. With the establishment of formal library science training, Chinese pioneers such as Shen Zurong and Yuan Tongli also brought in Western theories and practices of library management ranging from the Dewey Decimal System to open-book stacks.

We are witnessing a remarkably similar transformation in China today. Library professionals and educators are again leading the trend. Today, digital libraries, Internet cafes, and the numerous dot.com startups are springing up everywhere in the country. In the midst of this digital revolution is the proliferation of library schools and programs. In the past decade, the number of library schools has increased substantially, a trend that is in sharp contrast to that in the United States where some major library schools closed in the early 1990s. In addition to the flourishing of library programs in China, we also see a trend to change the names of the schools from "library and information science" to just the "information science." The dropping of the term "library" reflects the change of thinking by many Chinese library educators. As the knowledge-based new economy promises huge potential for placement, enrollment revenue, and social prestige, library schools in China have rushed to change their names as well as their curricula, as many library schools in the United States did in the 1990s. Although we must recognize the need for library schools in China to adapt to the fast-changing marketplace, we should also recognize the fact that certain practices in this transition are worrisome. For example, many library programs in China that traditionally enrolled predominantly liberal arts students have now changed their admissions requirements to enroll only science-track students. This change reflects their determination to turn today's library schools into tomorrow's training shops for high-tech workers.

A basic difference between library programs in China and those in the United States is that the former are predominantly undergraduate programs, while the latter are predominantly graduate programs. Most of the undergraduate students in China's library schools receive a B.A. in information science as a terminal degree. Science-track students receive much less liberal arts and humanities training. By contrast, most if not all library school students in the United States have had broad and solid liberal arts and sciences education before they embarked on a professional training course in library and information science. Such a simple observation could lead us to conclude that students in Chinese library schools (or schools of information science under their new name) today specialize a bit too early.

Well, it may not be too big a problem if those students all go on to become high-tech workers, Web masters, or database managers. The issue is whether library schools in China can train librarians for academic and public libraries without requiring a solid humanities and liberal arts education. Chinese scholarship dates back thousands of years, with rich publications and historical records. These publications and records are the sine qua non of most academic library collections. Without good training in language, literature, and his-

tory, one cannot easily manage such collections. On the other hand, China is still a country with impoverished libraries. The fight for mass education is not over yet. For example, most of the country's 3,000 plus counties do not have a good library, and many communities in China do not have any library at all. It will take many more years of hard work by library professionals to establish a solid library system in China. This should be one of the country's top priorities. Otherwise, the big leap forward in the digital revolution will leave many behind. To put it in a nutshell, this country needs more qualified and dedicated librarians who can serve and teach the masses and help build up communities. The sad fact is that such an urgent need has fallen into oblivion as the country marches in a fever toward the information age.

Here I want to emphasize the fact that a quality library program can coexist with a good information science program, and information science education can be built upon a good library program, without eliminating it. This is indeed what is happening in some of the top library schools in the United States. While some of the best library schools, such as those in Illinois, Michigan, Pittsburgh, and North Carolina, have vigorously expanded into the fields of information technology and information science education, they have also maintained their strong programs in library science. As I said earlier, most of their graduates enter with a solid education in liberal arts and humanities. This situation remains unchanged even under today's changed curricula. Many of those students will go on to become librarians and information specialists in libraries across the country, rather than being dot.comers in Silicon Valley, although there is nothing wrong with being a dot.comer. Indeed, being a dot.comer is glorious nowadays, to slightly modify a well-known quotation from Deng Xiaoping.

Conclusion

China needs more libraries than dot.com start-ups, and more librarians than dot.comers. The future of China's libraries and library education depends on the collective thinking of many of the library educators participating in this symposium. The Chinese have a rich and highly resilient civilization, one of the longest-lived in the world. To ensure the continuation of such a rich culture and civilization, the country needs to train more qualified librarians. I hope this vision is shared by all of us.

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A Comparative Analysis of LIS Graduate Education in China and the United States

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Abstract: *This article provides a comparative analysis of China's and America's library science graduate programs. Some of the areas included for comparison are the type and level of degrees awarded, educational missions, degree programs, disciplines and college names, and structure of the graduate systems.*

Introduction

Compared with the United States, China's library and information science graduate education system is young, with a history of just over 20 years. During these 20 years, our graduate education has made great progress. According to statistics released by the Parliamentary Congress Committee on Graduate Education, there are currently 32 places where a master's degree in library information and data management can be granted, and 7 places where a doctoral degree can be awarded.

As of the end of 1998, we had produced 1,465 students with a master's degree in library and information science and 43 students with a doctoral degree (Peng 2000). These graduates are currently making important educational and research contributions in the field of library and information science in China. However, we have to be conscious of the tremendous challenges that the revolution in information technology poses for library and information science graduate education. At the core of this technology is digital information.

Globally, library and information science is a discipline that is faced with the difficult task of restructuring its program and reassessing its value as an academic discipline. To create a world-class library and information science graduate system that can meet the challenges of the 21st century, China must keep tabs on global trends.

The United States is the birthplace of the world's first college of library studies,[1] and it is also the country with the widest scope of experience and expertise in library and information science education. This article attempts a comparative study of the library and information science graduate system in China and the United States. The objective is to provide some food for thought on how we can go about developing China's library and information science program, making it into a world-class system relevant to the 21st century.

1. Comparative Study of Graduate Degrees Awarded and Levels

The current library and information science program in China has resulted from the concerted efforts of many pioneers in the field. However, China only managed to put its library science master's degree program in place in 1981, and it did not have an information science master's degree program until 1984. The doctoral program was only started in 1990.

The development of the professional graduate degree system in the United States has a longer history. Since the world's first college of library science was founded at Columbia University in 1887, the development of America's library science education has taken on a life of its own. By 1919, there were 15 library colleges. This was also the year of Charles C. Williamson's landmark report, published by the Carnegie Foundation in New York. Based on the report, the American Library Association (ALA) drew up four different blueprints for library education. In 1933, the ALA published a paper on the "Minimum Requirements for Library Colleges."

In 1930, the University of Chicago initiated the first library science doctoral program. By 1982, the number of colleges of library science had increased to 70. By 1999, the number of schools accredited by ALA had already reached 56.

Within half a century, library and information science graduate education in both China and the United States has been transformed. However, the paths taken by each country are totally different.

I have selected the library and information science programs of the University of Southern Mississippi (USM) and Wuhan University as two cases to illustrate the differences between the two countries. Both universities are similar in their history and developmental progress, but by the 1990s, both universities had gone in different directions in terms of their graduate education.

Before 1988, the library and information science programs at Wuhan University and USM were fundamentally similar. They were either departments or schools operating under the university. But the similarities ended from then onward. China's model was a gradual specialization of both the library science and information science programs and their development was carried out in isolation from each other. On the other hand, USM integrated both programs, blurring the distinction between the two. This resulted in the development of USM's library and information science program, which comprises a wider scope of subjects.

Let's take a look at the type of degrees awarded. In China, the degree pathway is Bachelor of Arts (BA), then Master of Arts (MA), followed by Master of Science (MS), Master of Management Science, Doctor of Science, and Doctor of Management Science. USM has elected to go with Bachelor of Arts (BA) to Master of Science (MS), then Master in Library Science (MLS), followed by Master in Library and Information Science (MLIS). Based on the changes in the degrees awarded, it is obvious that USM is gradually steering its library science graduate program onto the path of becoming a library and information science interdisciplinary program. China has not even started to create a library and information science graduate education system.

USM is only one case to illustrate the development of library science education in the United States. The university also provides a micro-view of what is happening in America's library science education system, profiling the progress and trends within the country. We shall now move on to the University of Pittsburgh's library and information science program for our discussion of the next developmental trend.

The University of Pittsburgh's program is ranked among the top ten schools of library and information science in the United States.[2] Its number of enrolled doctoral candidates puts it at the top of similar schools of library and information science in the country. The school was originally called the School of Library and Information Science and comprised the Department of Library Studies and the Department of Information Science. The university adhered to this school name even in the midst of the renaming frenzy that took place during the 1990s. However, by 1997, the university relented and the school was renamed the School of Information Science. The two departments, Library Studies and Information Science, were renamed the Department of Library and Information Science (DLIS) and the Department of Information Science and Telecommunications (DIST) respectively.

Degrees awarded by the DLIS include the Master in Library and Information Science (MLIS) and the Doctor in Philosophy (Ph.D.). Degrees awarded by the DIST include the Bachelor of Science in Information Science (BSIS), Master of Science in Information Science (MSIS), Doctor of Philosophy (Ph.D.), Master in Telecommunications, and Doctor of Philosophy in Information Science and Telecommunications.

There are 9 to 11 American colleges offering bachelor's degrees in library and information science, 58 universities offering the master's program, and 10 universities with dual master's programs. In addition, 20 or more universities are collaborating with more than 70 professional bodies to offer combined degrees. There are also 28 places where doctoral degrees are awarded.

Currently, China does not offer dual master's degrees, combined degrees, or post-master and post-doctoral degrees. We believe that the library science program will inevitably evolve into the program of library and information science. The degrees awarded by the American universities are the Bachelor in Library and Information Science, Master in Library and Information Science, Master in Library Science, and Master in Information Science. On the other hand, the degrees awarded by China are the Master of Arts, Master of Science and Master in Management Science.

America uses the specialized degree system, with strong emphasis on the technical know-how of the library and information science profession. In contrast, Chinese universities impose very stringent requirements for the thesis because they are awarding academic master's degrees. At present, China has not yet started to build a specialized degree system, although it appears that the relevant authorities are studying the possibility of implementing a specialized master's program in library and information science. We believe that awarding a specialized master's degree would be better suited to the future needs of the library and information science discipline.

American colleges have established relatively more degree levels in their library and information science discipline, with strong emphasis on the master's and doctoral levels. In 1998, 87.5 percent of library and information science students admitted into China's universities were undergraduates, whereas only 19.9 percent of those enrolled in America's library and information science programs were undergraduates. During the same period, the number of master's candidates in the United States was 61 times that in China, while the number of doctoral and advanced level candidates in the United States was 22 times that in China.

The main source of recruitment of teaching faculty for China's library and information science education is the postgraduate pool. Hence, another consequence of a lack of higher levels of graduate education is the shortage of qualified doctoral teaching staff for our tertiary institutions.

In the United States, the number of teaching staff who hold the doctoral degree is 43 times that of ours. China's educational system has focused too much on undergraduate studies to the point that we have ignored the development of higher graduate level programs. This scenario might have been suitable for the needs of China a decade ago, but our present graduate education system is not capable of meeting the future needs of an information- and knowledge-based economy. I suggest that one of the most important tasks for the nation's library and information science graduate education system is to raise the levels of graduate education and boost the enrolment of graduate students. Some library and information science departments of certain polytechnics will have to be gradually upgraded to graduate schools of library and information science.

2. Comparison of Mission and Curriculum of Graduate Education

In 1998, the Parliamentary Congress Committee on Graduate Education drafted the *Catalog of Disciplines for the Conferral of Doctoral and Master's Degrees and the Training of Postgraduate Students*. This became the blueprint for our current education of graduates and postgraduates. In response to the *Catalog*, the Ministry of Education's Office on Graduate Education compiled and edited *Brief Introduction to the Conferral of Doctoral and Master's Degrees and the Training of Postgraduate Students*.

The *Brief Introduction* carries more authority and provides important guidance. It defines library studies as the science of studying information collection, organization, and application; librarianship; and the development and management of library systems.

The mission of doctoral programs in library studies is to produce multi-talented and competent professionals with integrity and moral character. They are to be grounded in the basic theoretical knowledge of library science. They are also required to possess highly specialized knowledge in their specific areas. These graduates are expected to be able to carry out independent and creative field research. They are trained to be competent teachers and research fellows in higher institutions, and are expected to excel as upper-level managers in large information agencies (Parliamentary Congress Graduate Education Office, Ministry of Education Office of Graduate Education 1998).

The same source described the goal of the master's program in library studies as being to produce multi-talented and competent professionals with integrity and moral character. They are to be grounded in the basic theories of library science. They are required to have some specialized knowledge. These graduates should be prepared to carry out independent scientific research, and to be competent mid-level managers in medium-sized information agencies.

There are four research directions in the doctoral program in library studies: library science theory, library science application, modern cataloging, and documentation. The master's program has seven research directions, which include library science theory, literary resources development, document classification and indexing language study, catalog study, library automation and digitization, information consulting, and documentation and publication. The courses offered by the doctoral program have to include an introduction to the principles of documentary information science and basic courses such as the development of library science. The program should include specialized seminars library science, cataloging, and documentation. The courses in the master's program should include basic theoretical courses, such as the documentation and practice of library science, and specialized topics such as basic library science theories; catalog studies; bibliographic information needs and service organization, classification, and subject area studies; search language study; index study; library automation and management; international exchange of information services; China's catalog history; the handling of rare books; the history of documentation; publication; and information resources and intellectual property.

The *Brief Introduction* defines information science as the study of the production, processing, channeling, and usage of information. It also includes the basic principles and applications of the development and management of information systems.

The doctoral program in information science aims to produce multi-talented and highly competent professionals with integrity and moral character. They are to be grounded in the basic theoretical knowledge of information science, possessing specialized knowledge of certain fields as well as a broad understanding of the relevant subject matter. The graduates are expected to be independent researchers with practical skills. They should be able to take on teaching and research duties in tertiary institutions and professional research bodies, and should excel in their roles as high-level information managers in business corporations (Parliamentary Congress Graduate Education Office, Ministry of Education Office of Graduate Education 1998).

The master's program in information science aims to produce multi-talented and competent professionals with integrity and moral character. They are to be grounded in the basic theoretical knowledge of information science and have some specialized knowledge of their field and a basic understanding of relevant subjects. They must also be computer savvy and able to process and manage information using computer systems. Graduates are expected to undertake teaching and research duties in higher-level institutions and professional organizations, and to be competent in the role of managing information within business units.

The doctoral program in information science comprises five concentrations: theory and strategies of information science, prediction and research in information science, information resources management, creation and networking of computer information systems, and the knowledge-based economy.

The master's program includes seven research directions: theory and strategies of information science, prediction and research in information science, information resources management, information retrieval, information services and consulting, creation and networking of computer information systems, and the knowledge-based economy.

The doctoral program should include basic courses such as the progress of information science (including the history and progress of different fields), the theory of information science, and the creation of computer information systems. Specialized electives should include information retrieval systems design and evaluation, the policy and study of information science, analysis of the knowledge-based economy, information services and consulting, information science management, information database and retrieval strategy, and the documentation and quantitative study of materials and information.

The master's program should consist of basic theoretical courses such as the theory and applications of information science, information analysis, computer information retrieval, information management and policy, computer information systems, and the principles and use of online information resources. It should also include special electives such as information resources management, information users and service, the theory and application of information consulting, knowledge-based economy, quantitative study of information, information policy and intellectual property, information retrieval, database system design and evaluation, Web technology, and intelligent information systems.

Curriculum development is a key factor influencing our chances of achieving our educational goals. The information technology revolution and the new information environment have brought new challenges to the creation of the library and information science curriculum. In response to these challenges, American universities have made major adjustments to their graduate curriculum.

First, American universities have stopped offering courses that are either too narrow in focus or are outdated as a result of the drastic changes taking place in the field. Their curriculum is built with the macro-view of information resources in mind, discarding the traditional practice of developing courses based on the boundaries put in place by types of libraries or the various departments within them. The focus has shifted from the concept of a library as a separate body in society to one that encompasses the whole society's information and knowledge system. The courses that have become obsolete include public libraries, special libraries, and college libraries. An interesting point to note is that in a period of three years, almost all universities have stopped offering the course computer application in libraries. This is in stark contrast to the early 1980s, when it was offered in almost every university. Schools have replaced this course with courses on online information retrieval, digital libraries, and databases.

A second adjustment that American universities have made is to work hard at improving their programs to meet the needs of a knowledge-based economy by expanding and specializing in the areas of knowledge and information management. Courses such as library collection and library classification have been renamed "information development in society," "knowledge organization," or "information structure."

Third, American universities have gone one step further in the adjustment of their core subjects by designating a pool of subjects as electives so that students not only have more choices but also a chance to get a better grasp of their specialized fields. For example, the core courses offered in the School of Information Science at the University of Pittsburgh include:

- Understanding information: Issues and problems arising from interrelationships among information and individuals, society, organizations and systems;
- Organizing information: The theory and practice of organizing information in all types of environments: principles, standards, and tools, with special emphasis on understanding the function of catalogs, indexes, bibliographic utilities, and other organizing entities;
- Retrieving information: An overview of the information retrieval process, from creating information resources to delivering information to the end user. This includes theory and practice of understanding various users of information and their information needs; identifying appropriate resources from the range of types and formats available; formulating retrieval strategies; and identifying information appropriate to the end user.
- Changes in information environment management: Principles of interpersonal and organizational behavior and the application of the principles to information management and decision-making.

These are also the required courses in the Department of Library and Information Science. Besides the core courses, there are also three general courses: methods and applications, legal issues in information handling, and information ethics. In addition to the core and general courses, the Department of Library and Information Science offers the following electives:

- Book arts, preservation and archives
- Resources and services for specific patron groups
- Organization of information
- Subject area resources and services
- Information technology
- Organizational behavior
- Individual options

Courses that cater to information science undergraduates include: overview of information science, data structure and programming techniques, file processing, data statistical analysis, program design and programming language, tele-

communications, library information system programming and design, graphics, information system design, computer programming, database management systems, information system analysis and design, information storage and retrieval, human information processing, human factors in system design, organizational behavior, human/computer interaction, artificial intelligence, theory in digital communication, and independent study and practicum (University of Pittsburgh 2000).

The mission of the University of Wisconsin-Madison School of Library and Information Science is to prepare students for a wide variety of positions available in libraries and information centers, and for other information work (2000). The information professions are concerned with the ways people create, collect, organize, store, analyze, find, distribute, and use information. Employment opportunities in the information field are abundant; some examples of these opportunities are librarian, information resources manager, abstractor or indexer, archivist, online search specialist, information broker, library systems analyst, and information products and services sales representative. The core of the program focuses on information collection, storage, and design, and the application of effective information systems. Hence, all students are encouraged to take the following core courses:

- Information agencies and their environment
- Organization of information
- Information use and users
- Information sources
- Information services management

The school places special emphasis on a varied undergraduate background. For enrollment, a completed undergraduate program that includes breadth in liberal arts and sciences, with a strong subject specialization in a major discipline (e.g., science, history, or literature), an applied science (e.g., engineering, computer science, or business administration), or a profession (e.g., law or education) is a requirement. Approximately 90 semester credits are normally required in the undergraduate program. These 90 credit points exclude any credits awarded by the undergraduate courses of the Library and Information Science Program.

If a new student lacks grounding in other disciplines, he or she can choose to make up for that by enrolling for courses outside of the required core courses in the master's program. A teaching certificate or practical work experience can also be substituted (this is applicable only to students enrolled in the master's program in School Library Media Center or Archives Administration). An alternative is to enroll in the double degree program.

The University of Washington's program is focused on "information organization, storage, retrieval and management." The core subjects are:

- Society, users, and libraries
- Bibliographic control
- Introduction to information science
- Bibliographic databases

There are five areas of concentration, each consisting of a number of courses. Students have to enroll in one course from each of the five areas of concentration. Together with the core courses, 63 credit points are required for graduation (University of Washington 2000). The five areas of concentration are as follows:

1. Managerial tools. Courses include management for librarianship, library administration skills, management of automated systems in libraries, management techniques of library information science, administration of the school library media program, and research methods in library science.
2. Organization of resources. Courses include introduction to the organization of library materials, descriptive cataloging, subject analysis of library materials, organization and use of serials, indexing and abstracting, construction of indexing languages, and literature search.
3. Information resources and retrieval. Courses include materials for general information needs, information access in humanities, information access in the social sciences, information access in science and technology, legal eesearch, government publications, business information resources, evaluation and selection of audiovisual materials, children's materials: evaluation and use, young adult materials: evaluation and use, and information access in the health sciences.
4. Design and provision of information services. Courses offered include user education: issues and practice, planning for library and information services, services for special groups, special librarianship, public library services for the adult, administration of the school library media program, and archival services.
5. Environments of Information Service. Courses offered include intellectual freedom in libraries, cooperative information systems, information policy, information in the public policy-making process, and legal issues in library information.

The law librarianship program has the same core courses as the program in Library and Information Science, and the required courses are legal research I, legal research II, selection and processing of law library materials, and legal cataloging. Students have to earn a minimum of six credits from two core concentrations, namely, organization of resources, and information resources and retrieval.

The School of Information Management and Systems (SIMS) at the University of California at Berkeley was created as a result of the restructuring of the previous School of Library and Information Studies. It is also one of 14 schools of the University of California at Berkeley. After changing its name, it succeeded in creating a culture that was different from that of traditional schools of library and information

science. Its mission is to educate information managers. Working in a library is just one of the employment opportunities for graduates.

SIMS claims that its curriculum does not follow ALA standards (it is the one and only school to claim so). However, its curriculum is still a combination of core courses and specialized electives (University of California at Berkeley 2000).

The core courses offered are as follows:

- Information organization and retrieval (4 credits)
- Information users and society (4 credits)
- Distributed computing applications and infrastructure (4 credits)
- Analysis of information organization and systems (4 credits)
- Cognitive approaches to information (3 credits)
- Group and organizational approaches to information systems use (3 credits)
- Information in society (3 credits)
- User interface design and development (3 credits)
- Needs assessment and evaluation of information systems (3 credits)
- Information services (3 credits)
- Information skills for professionals in the public and nonprofit sectors (3 credits)
- Privacy, security, and cryptography (3 credits)

The following main electives are offered:

- Management and policy, with subjects such as the management of information systems and services, information policy, and marketing information, products, and services.
- Economics and law, with subjects such as economic methods for decision-making, the economics of information, legal issues in information management, and intellectual property.
- Organization, retrieval and representation of information, with subjects such as the principles of information retrieval, organization of information in collections, multimedia information, visualized information and presentation, and the preservation and conservation of information resources.
- Information technology, with subjects such as computer-based communication systems and networks, data and file structure, and database management.
- System analysis and design, with subjects such as system implementation: use of database management systems, system implementation: use of programming languages, and system implementation: use of authoring tools.
- Research methods, with subjects such as quantitative research methods for information management and qualitative research methods for information management.
- Application areas. This elective will be expanded in the future to cover areas such as health/medical information systems and legal information systems. Subjects currently offered are design of library automation systems and geographical information systems.
- Seminars and individual/group study. Seminars include special topics in information management and systems, doctoral colloquium, individual study, and so on.

The feature that distinguishes SIMS from other traditional library and information science colleges is the omission of the term "library" from its course names.

The mission of Kent State University's Library and Information Science program is to train students to be able to:

- Analyze the changing cultural, educational, and social roles of librarians and information professionals, and the position of the library and information in society;
- Select, acquire, and process information resources for libraries and other information agencies;
- Interpret and effectively use general and specialized information sources and bibliographic tools;
- Organize and describe information materials in a manner that will facilitate and enhance the use of resources;
- Interpret and apply basic management principles to decision-making in librarianship;
- Describe advances in technology pertinent to the acquisition, organization, and dissemination of information and apply this knowledge to libraries and other information agencies;
- Conduct research in the field of librarianship and relate the findings to the solution of problems in the profession;
- Analyze the information needs and design information services to meet user needs.

The required subjects are foundations of librarianship, access to information, organization of information, and research for decision-making in libraries and information centers (Kent State 2000).

Based on the comparisons, it is clear that China's graduate education system is positioned for the training of academic and research talent, while the United States has set its sights on training professionals with practical knowledge of information resources application and use. The mission of China's graduate education system is much more lofty than that of the United States. This is reflected in the stringent standards imposed on our master's dissertations. Chinese universities have limited fields of specialization, and students are pigeonholed early on in the course. Hence, the graduates have strong research skills but lack breadth of knowledge, which affects their adaptability in the real working world.

American graduate programs are aimed at producing industry professionals with practical knowledge. Students are not boxed into any specialized field at the master's level. Moreover, many universities do not require dissertations. With the wider choice in courses, the graduates are given a chance to build breadth of knowledge and are better prepared for the demands of the working environment.

Another difference in educational mission is the length of time required for completion of the master's program. At institutions such as Wuhan University, Peking University, Nanjing University, and the China College of Science, students need at least three years to complete the master's program. In the United States, students can attain a master's degree in eight months to a year. Shortening the length of time required for completing the master's degree would also improve the efficiency of China's graduate education system.

The total number of library and information science postgraduates produced in China is only a quarter of the total number of postgraduates produced in the United States in 1998 alone (5,800).

3. Comparison of Discipline and School Names

Since the 1980s, America's library science education system has undergone several important transformations. First of all, private universities such as the University of Chicago and Columbia University have closed their departments of library studies. Second, the renowned public universities such as UC Berkeley have discarded the old library science training methodology and revamped their library and information science programs. They are now known as Information Management and Information Systems programs. Third, public universities such as the University of Pittsburgh have renamed their School of Library and Information Science the School of Information Science. The University of Michigan, University of Tennessee, and University of Washington are also undertaking such a renaming process. Finally, there are still many institutions, including Kent State University, that are adhering to the system of the School of Library and Information Science. Among these trends, the third and fourth have dominated the restructuring of American library and information science education.

Another transformation occurred during the mid-1990s: the revamping of the library and information science education system. The focus of this transformation was the restructuring of the library studies education infrastructure, including the curriculum and degree system. Based on a survey of the 58 colleges accredited by the ALA, most have elected to rename their schools the School of Library and Information Science.[3]

China's library and information science education system is going through constant change as well. In 1987, the then Education Parliamentary Committee published a *Catalog of Social Science Disciplines Offered Under Normal Tertiary Institution's Undergraduate Curriculum*. There were six disciplines listed under the category of Library and Information and Archival Studies. Library science was one of them.

From the late 1980s to the early 1990s, departments of library and information science of many Chinese schools were renamed Department of Information Management. Among these were the Huazhong Teachers' College, Zhongshan University, Zhengzhou University, Beijing Teachers' College, and Peking University. In the late 1990s, numerous polytechnics and vocational schools also jumped on the bandwagon by offering information management and information science programs. According to statistics, there are more than 160 local universities offering information management and information science courses. The titles of graduate programs did not change at all. This is because the Parliamentary Congress on Graduate Education stated quite clearly in the 1997 draft of the *Catalog of Disciplines for the Conferral of Doctoral and Master's Degrees and the Training of Postgraduate Students* that the graduate degrees awarded by universities must correspond to the discipline categories as stipulated in the draft. Library and Information Science and Archival Studies is considered one academic discipline; Library Studies, Information Science, and Archival Studies are classified as academic programs under the discipline.

In comparison, America's undergraduate program is usually known as Library Science or Information Science (second-level discipline), while the graduate program is generally known as Library and Information Science (first-level discipline). American graduates are enrolled to the first-level discipline, while China's graduates are enrolled in the second-level discipline.

In China, Library Science and Information Science are the general terms used for the graduate programs, while the undergraduate program is frequently known as Information Management. One exception is Wuhan University, which continues to use Library Science for its undergraduate course but has changed the information science course to information management and information science.

4. Comparison of the Graduate Degree Structure and the Size of Student Intake

Total student intake is one important indicator of the development of the library and information science education system. Since the 1960s, American schools of library and information science have upgraded their educational programs, resulting in more than 50 schools where master's degrees can be granted, and 27 where doctoral degrees can be awarded. The number of LIS students admitted into the various degree programs every year is about 19,000. China is lagging behind with a figure of only 2,280 per year. As the attrition rate in our undergraduate and graduate programs is very low, about 2,280 students are awarded bachelor's, master's, or doctoral degrees every year.

In contrast, the American schools have a higher attrition rate. The student intake for 1991, 1992, 1993, 1994 and 1995 was 17,535, 17,918, 17,590, 17,378, and 18,219 respectively. The number of graduates for that same period was 5,018, 5,472, 5,376, 5,149, and 5,520 (Wallace 1996). Based on these numbers, we can tell that China's system is very strict in terms of admission and completion, while American schools are more lenient in their intake but have stricter standards for completion.

Besides student intake, level of entry into the program is another major difference between China and the United

States. In the fall of 1997, 76 percent of America's LIS students were admitted to the master's level, and 4.08 percent were admitted to the doctoral or post-master's level, while 19.9 percent were enrolled in undergraduate programs. In contrast, China's distribution of the LIS student population forms an upside-down pyramid. We admit about 2,000 undergraduates, 200 master's degree students and 40 doctoral candidates. The total new student enrollment is about 2,240 (excluding figures from the adult education program). This means that 89.28 percent of newly enrolled students are undergraduates, 8.93 percent are master's degree students, and 1.79 percent are doctoral candidates. This, in turn, has affected the number of degrees awarded. The United States awarded 5,800 master's degrees and 280 bachelor's degrees in 1998. It is obvious that the focus of America's LIS education system is on the graduate level, while China retains its emphasis on the undergraduate level.

5. Conclusions

Using comparative analysis, I have drawn the following conclusions:

1. For library and information science education to keep pace with the needs of the times, it has to make constant adjustments and undergo restructuring. Technological, societal, and economic factors are the catalyst for this change. The propelling force behind this transformation is the change in the information needs of users. China and the United States are changing to prepare themselves for these challenges. The modern era of digital technology brings with it challenges and opportunities for library and information science education in the 21st century. It has to meet the demands of users' changing information needs and the requirements of a knowledge-based economy.

In the midst of such changes, LIS schools should strive to retain their unique characteristics or create a brand new culture. China's LIS schools belong to varied institutions. Some are departments or schools in polytechnic universities, teachers' colleges, and specialized colleges (e.g., medical colleges and technology colleges). Some have a long history while others are relatively young. Whichever category they belong to, it is imperative that they create their own niche program to suit the needs of different areas of expertise. It is not advisable to have only one model for the education of LIS professionals. Instead, there should be a multidisciplinary and multidimensional approach to the teaching of library and information science subjects (Hu 1999).

China's LIS program is on par with America's in the 1980s, as demonstrated by the size of the student population and intake, as well as the rate of increase in the number of schools offering master's programs. In reality, each of the 50 or more schools accredited by ALA has a unique approach and strength in its LIS program. Some schools are research-oriented, with their doctoral programs ranked among the top in LIS education. Other schools are industry-oriented, making the master's programs very popular with industry.

The truth may hurt sometimes, but it is important to be creative. Many of China's LIS graduate research fields were copied from other countries' programs. It is rare to find fresh and creative ideas in the research fields in Chinese LIS programs. This is also reflected in the content of our curriculum.

Courses offered by Chinese universities, such as quantitative study of materials, comparative library studies, competitive information studies, bibliographic control, and online library studies, were created by academics of other countries, then introduced to China. Concepts such as the paperless society, the demise of the physical library, and information resources management are all the brainchild of professionals abroad.

Over the long term, if China's library studies programs only copy others, they will never achieve world-class status. One of the reasons is that while we are playing catch-up, the source we are copying will have already moved in new directions. This clearly demonstrates the tremendous need for creativity in China's library and information science education system.

2. Change should not stop at superficial levels such as renaming subjects or colleges. Change should extend to a deeper level of the discipline in order to help it adapt. If you look at the transformation in American institutions, you will notice that, on the one hand, they began by restructuring departments and colleges and renaming schools, changes that are more superficial in form. On the other hand, however, they also began restructuring at a deeper level. Many universities discarded or revamped their curriculum between 1996 and 1999. They threw out some old subjects and added new courses, including online library studies, digital libraries, and online information services. In addition, they changed the graduate education system and their internship programs.

China is also going through a change. We have observed that the focus of the change has shifted from the renaming of colleges to the adjustment and specialization of the entire discipline's infrastructure and content. Changes in program content benefit the overall development of library and information science education. Without extensive changes in content and structure, we will miss our target, and our dream of building a world-class program will be shattered.

3. We should encourage the creation of interdisciplinary degree programs. Library and Information Sciences should be an open discipline, welcoming and introducing new knowledge and new subjects. However, the discipline remains isolated. As a case in point, journals of library and information science quote liberally from journals of other disciplines, but are hardly ever quoted by other disciplines in their publications. Library studies articles appear mainly in their own professional publications. They are seldom seen anywhere outside

the field. Many library science students enroll in courses offered by other disciplines, but the library and information science faculty does not encourage or create such opportunities of exchange for students from other disciplines.

In comparison, in the United States, many of the library and information science professional bodies cooperate with other professional organizations to offer cooperative degree or double degree courses. Students spend half their time studying library and information science subjects, and the other half studying other disciplines (such as history, legal studies, music, or business management). Other departments offer interdisciplinary courses to library and information science students, and library and information science departments reciprocate with similar programs. Library and information science graduates are employed by various government agencies and leading corporations as information managers or in some similar role. A few graduates have even become information policy consultants to the president. In China, we can and should experiment with such concepts as offering dual degrees, cooperative degrees, and even law librarian master's and post-master's degrees.

4. The obstacle to revamping our LIS graduate education system is the training of practical professionals at the disciplinary level. China has made a distinction between the development of library studies and information science, with each discipline training its separate pool of graduates. When the graduate system was first established in China, the lack of qualified teachers for the graduate program made it necessary to demarcate professional disciplines.

However, the two disciplines are similar in many ways. Looking at the last 50 years of information science development, it is obvious that the discipline is the product of an integration of library science and modern computer technology. If we look at staffing needs, student intake, and graduate profile, there are many areas of overlap between the two disciplines. Countries where schools of library studies and information science are more established have unanimously treated library studies and information science as a single discipline. For example, there is no "pure" library studies department among the ALA-accredited colleges. In the development of the discipline and its degree system, almost all of the American schools have replaced "library studies" with "library and information science." Take the University of Pittsburgh as an example. Its doctoral program has the highest enrolment and is ranked among the top five and best-integrated LIS schools. It has also renamed its Department of Information Science the Department of Information Science and Telecommunications. The Department of Library Studies became the Department of Library and Information Science. According to my investigation, each of the top 10 LIS schools in the United States[4] has elected to name its school the School of Library and Information Science.

The next step in the global trend is the gradual transformation of these disciplines into the discipline of Information Sciences. One point worthy of consideration is the use of the plural "Sciences." For instance, University of Pittsburgh, which is recognized as one of America's earliest schools of library studies, finally established a School of Information Sciences after a long series of changes.

Our discussion of the preceding issue is not intended to negate the independent status of library studies and information science, but to put forward the argument for integrating the two disciplines. This would bring about better use of staff, materials, technical resources, and facilities in training professionals. In the digital age, this trend is becoming more obvious.

Printed materials will continue to exist, but the merging of printed materials with various online information and media forms has become a driving force in the development of the modern information age. It is difficult to determine whether online information (transmitted via cable, telephone lines, or wireless) originated in the content of library studies or of information science. In reality, this kind of distinction is meaningless. But the dissemination of online information (including the digital library) will require technology related to catalog classification, search language, indexing, quantitative methods, information packaging, mass information dissemination, information organization, and information storage. These technologies are at the core of library studies as well as of information science.

The enrollment, training, and curriculum development of our graduate system is still stuck at the academic program level. This situation is grossly incongruent with the needs of the digital era. I understand that the Parliamentary Congress Committee on Graduate Education is undertaking a review of the academic disciplines. I believe this is an excellent opportunity for the library and information science graduate program to fight for recognition as an academic discipline. It is also a chance for new ideas to be implemented that will break down the barriers between library studies and information science. We should insist on the integration of procedures for staff selection, teaching methodology, and awarding of degrees for the two programs. Graduates should narrow their scope of research only when they start their dissertation. The 1998 draft of the *Catalog of Disciplines for the Conferral of Doctoral and Master's Degrees and the Training of Postgraduate Students* is consistent with the global trend toward an interdisciplinary approach. In fact, it has provided a blueprint for the review of the academic disciplines.

The goal of graduate education should change as the information environment in society changes. In a digital age, the goal of graduate education should be to nurture creativity. The information environment is changing fundamentally; at the core of this change is a shift from analog to digital in the work environment of library and information science. In the age of analog information, there was a growing body of knowledge on the storage, organization, and retrieval of information. But in the digital age, the pace of change in infor-

mation technology is phenomenal and unmatched by the analog age.

Digital technology is bringing change in the production, collection, packaging, retrieval, dissemination, replication, and reprocessing of information. More importantly, the needs of users have also changed fundamentally in the digital age. The digital age is an era of technological creativity. President Jiang Zemin has said on various occasions that creativity is the soul of a nation's progress and the unfaltering force behind a nation's prosperity. Ministry of Education Minister Chen Zhili has said that creativity, practical knowledge, and entrepreneurship are important ingredients in a quality education. They are also important components of a good graduate (Chen 2000).

The Ministry of Education's Office of Graduate Education has also identified the enhancement of creativity among our graduates as an issue that warrants priority in consideration (People's Republic of China Graduate Stipulations, Feb. 12, 1980). Graduates are still spoon-fed by their teachers. Because their knowledge base lacks breadth, it is difficult to innovate. There is a huge number of dissertations written by graduates, but so far, none has been selected for entry into the annual Best 100 Theses competition.

In China, once students enter their graduate studies, they select a tutor and begin their specialization in the tutor's area of interest. This is useful in the training of experts in a specific field, but this methodology is unable to meet the developmental needs of the library science discipline. In the digital era, the professional boundary between library studies and information science is gradually disappearing. In the interactive World Wide Web, the boundary between information provider and user is also fuzzy. Qualified and excellent information managers have to have breadth of knowledge. The creation of specialized and distinctive positions for the work of classification, cataloging, retrieval, collection, searching, and so on is meaningless. These tasks are now handled by a single automated system. If the specialization is too narrow and there is a lack of fundamental knowledge, creativity will be limited. Hence, I propose a small-group teaching methodology. That is, a student will have a mentor group comprising his or her supervisor and a few other associate professors. There must be at least one member of the teaching staff who possesses a different field of expertise from the supervising tutor.

5. *Curriculum restructuring should focus on adapting to changes in the information environment and information needs.* Curriculum development directly affects the quality of the graduates. Currently, our graduate studies suffer from the perpetuation of cosmetic changes. There is an absence of profound changes to the teaching content. Such a model is not capable of meeting the needs of today's information technology development.

The curriculum review must proceed with the understanding that library and information science is a management science discipline. The goal of the curriculum is to nurture individuals who are competent in a range of areas, and who are creative. After careful analysis of library and information science programs in China and abroad, I have come to the conclusion that the graduate program should comprise two parts: one is the professional core courses and the other the research-oriented courses.

The core courses aim to help students develop a strong grasp of theories and the specialized knowledge of the system (master's level), or develop the breadth of knowledge of theories and specialized expertise. This is the basis for preparing students to attain broad knowledge. The core subjects include information organization, storage, and retrieval, and management.

The core courses can be further divided into required courses and electives. The required courses could include introduction to library science theories, information science, archival studies, cataloging, history of LIS, schools of thought, future development, progress, and methodology. Areas to be covered in the content are an introduction to the study of library and information science, and research methods in library and information science.

The electives should consist of five courses:

1. Information organization and retrieval, mainly the teaching of information organization technology, including bibliographic control, indexing and abstracting, the construction of indexing languages, the design of modern retrieval systems, digital library technology, and online information organization.
2. Information resources and evaluation, focusing on the theory and practice of information resources construction; various types of information resources; selection of information resources; the evaluation of selection policy; and the evaluation of information from the social sciences, humanities, natural sciences, and engineering technology.
3. Information services, with a focus on the theory and practice of information services including the study of information needs and users, information protection, bibliographic information services, and other specialized services, such as records management and rare book services.
4. Management sciences, focusing on administrative management, the design and planning of information services, the automation of library systems, human resource needs, and budgeting and finance management.
5. Information environment, with emphasis on the study of legal and economic issues in information management.

Students would be given a choice of one or two subjects from these electives. For example, within the information resources and evaluation elective, one could choose introduction to information resources, information resources in humanities and social sciences, information resources in science and technology, research methods in information resources, or information resources in the legal profession.

The development of the curriculum should take into consideration the change in the information environment and users' needs. In the digital age, users are no longer content only with print versions of information; they also demand multimedia forms. In this new information environment, where audiovisual information merges with the traditional forms of information, requests are increasing for information in many formats.

The sort of information that users demand has shifted from that which is defined by location, such as national or regional information, to that which is of an international nature. Traditional services provided by library and information science professionals used to be geographically bound; for example, bibliographic services based on book collections available in a particular library, and inter-catalog services compiled for the region. In the digital age, bibliographic centers that were once limited by geographical location can now share their resources with others over the Internet. In the process of global information sharing, the reporting style of information has changed fundamentally—as the reports of the virtual library, for example. They are not bound by the rules of bibliographic control but by telecommunications agreements. Hence, we have to consider seriously the issues revolving around the sharing, dissemination, and usage of information in the Web environment.

In the traditional sharing of information, we rely heavily on libraries, information centers, and documentation agencies, and these services are usually centralized. The methods of information retrieval are to borrow, browse, and look up catalogs and references. In the information age, as a result of technology changes, audiences are not as reliant on the physical library. The virtual library with its distributed database can satisfy the needs of information seekers. Information seekers want to receive information through their computers or wireless devices, regardless of their location, whether they are at home, in the office, or on the road. Constant availability is the unique feature of 21st century information exchange. There is no limit on the replication of information resources. Point-to-point information exchange is also an important trend, brought about by the commercialization of information services. We therefore have to seek out new channels for information sharing. We have to study the new responsibilities of the digital library information worker, and the information-seeking behavior of users in the Web environment.

The current challenge is how to help audiences retrieve swiftly and accurately the information they need from the mass of information available. The study of cataloging is aimed at giving audiences summary information about a literature so that they can decide if they want to further pursue the information.

With the availability of digital information, audiences have turned their attention from traditional information sources to digitized information sources. The information infrastructure is a common platform that influences everyone. The availability of digital information has also changed the way in which audiences use information. Digital searching is fast, and offers unique services such as wireless communication, human-computer dialogue, and on-the-spot editorials. It is convenient and easy to store, and facilitates the replication of information. Digital information service is very different from traditional service.

Let's take a look at the retrieval process. The pattern of query–compare–search will be gradually transformed into the pattern of browse–search–download. Hence, there is a need to look at new areas of service, such as subject area, consulting, counseling, and related psychological or behavioral science issues.

The changing needs of information users are fueling new library and information science research. The change in the information environment will bring with it a new set of issues with technological, cultural, psychological, and legal aspects. Library and information science professionals have to continue their research in these areas. These issues should also be given due consideration in the curriculum of our graduate program.

6. One of the keys to transforming China's graduate education system is to revamp the graduate teaching faculty. The quality of the graduate faculty is one of the major factors that will determine the success of the transformation of China's graduate education system. Currently, the main issues facing China's LIS teaching staff are the imbalance in age structure and the incompleteness of the staff's knowledge base. There is a dire shortage of young academic leaders and information technology lecturers. It will be difficult to meet the requirements of LIS education in the digital age if we continue to face such shortages.

Let's take a close look at the age structure of both American and Chinese teaching faculty. The 58 American universities accredited by ALA employed a total of 601 LIS teaching staff. Among them, 10.4 percent are 40 years old or younger, 58.2 percent are between 40 and 54 years old, 25.9 percent are between 55 and 64 years old, and 5.5 percent are 65 years old or older. Among China's LIS teaching staff, 37.18 percent are 40 years old or younger, 32.56 percent are between 40 and 54 years old, 25.58 percent are between 55 and 64 years old, while 4.65 percent are 65 years old or older.

The age of Chinese faculty is comparable to that in the United States with respect to the 55 to 64 year-old category, with a similar ratio of 25.58 percent and 25.9 percent. The ratio in the 65-and-older category is also similar. However, there is a great difference in the 40-to-54-year-old group between the two countries. China has a low ratio of middle-aged teachers. In Wuhan University, the ratio for this age group is 32.56 percent of total staff strength, which is very low compared to America's ratio of 58.2 percent. Boosting the ratio of middle-aged teachers among the faculty is a key strategy to building a staff base with a balanced age structure. Tactically, the training of teachers in that age group is extremely important.

The type of qualifications held by the teachers is also an important indicator for assessing the quality of the teaching staff. Most of China's university faculty members hold master's or bachelor's degrees, and those who have a doctoral degree constitute only one percent of the total staff strength. As the source of teaching staff for LIS courses comes from local graduates, the small number of graduates means that tertiary institutions are not able to recruit enough doctoral candidates as teachers.

Libraries are an important component in the national information infrastructure, and information technology poses a unique challenge to the library. As the information infrastructure improves, many of the traditional functions of the library will be served by other information agencies. Commercialized information services are constantly competing with the library for clients, and thus reducing the number of library users. In addition, high salaries at commercial information agencies have lured many information technologists away from traditional agencies. The number of applications for LIS programs has dropped. The profession is in a crisis of not attracting enough students. Under such circumstances, some schools of library and information science have begun to change their programs. Some have been successful and others not.

The deficiency in China's LIS program structure is a long-standing one; curricula were not properly reviewed and teaching conditions were not improved. Consequently, students have been left in the lurch. It has become obvious that they are not competent in their own field and lack knowledge in other disciplines.

The information highway is an information chain consisting of hardware (computers), Internet service providers (ISPs), Internet content providers, and end users. Within this chain, manufacturers monopolize the hardware industry, while ISPs are the domain of computer industry experts. That leaves Internet content providers as the only field open to LIS graduates. This field focuses on the collection, promotion, packaging, and dissemination of data. Work with Internet content providers requires a broad base of specialized knowledge; for example, some knowledge about chemistry would be necessary if one were to undertake the creation and packaging of chemistry literature databases.

The United States pays considerable attention to the interdisciplinary background of teachers. China, on the other hand, ends up with a teaching faculty that is predominantly LIS graduates. It is rare to find staff members who are graduates of other disciplines.

The situation illustrates the pressing need to engage teaching staff with interdisciplinary background. Schools of LIS in Europe and the United States emphasize interdisciplinary training of their teaching faculty. For instance, in 1998, out of 31 assistant professors employed by the 58 schools of LIS in the United States, 46.2 percent held doctoral degrees that were awarded by other disciplines. This included disciplines of computer science, education studies, industrial technology, and philosophy. By 1998, the number of doctoral graduates from non-LIS disciplines was 183, which is 30.4 percent of the total number of LIS staff (601). China should encourage staff with training in other disciplines to teach in our library and information science schools.

Endnotes

1. The School of Library Economy was established at Columbia University in 1887 with the support of its president, Frederick Barnard.
2. In 1996, *U.S. News and World Report* ranked the school fifth among America's top 10 colleges of library and information science.
3. The survey included two Canadian colleges, as they are also accredited by the ALA.
4. According to *US News and World Report*'s ranking in 1998.

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The Enhancement and Expansion of Information Science Graduate Degree Courses in the Digital Age

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Abstract: *Because of the growing role that information plays in today's society, professional information science education is a constant state of change. This, in turn, has influenced the structure and provision of education in the field. Delivery of information science postgraduate education faces the same challenges as any other high-level professional qualification. These challenges in the new century have inspired the development of new degree courses and teaching methods that are central to the development of a new generation of high-level professionals. Based on an analysis of the demand for and changes in the training of information science professionals in the information age, this article explores the reform and development of degree course systems, the expansion of content to be covered, and teaching methods used. It concludes with an examination of proposed relevant strategies.*

As society moves into the digital age, the integration of occupational tasks and information services, combined with continual advances in information technology and global networking, require information professionals trained by institutes of higher learning to possess both a broad base of professional knowledge and systematic and in-depth expertise and skills to meet the various demands of society. The requirements of competency and specialization reflect the reforms taking place in the systems and teaching methods of information science postgraduate courses, characterized by the deepening and expansion of degree courses on the basis of formulating objectives for the fostering of information science graduates.

1. The Formulation of Objectives for Fostering Information Science Postgraduates in the Digital Age

For some time there has been little connection between the disciplines of library and information science (including literature information management) and those of business administration information systems and economic information management in the United States, the European Union, and other developed regions. These specialties developed independently, with the result that those in each field were unaware of the related academic research in the other. The reasons for this situation are largely historical. As economic information, consulting, and brokerage services started relatively early in developed countries and grew into sizeable industries, the organization, service content, growth, and processes of these industries differed from those of libraries and traditional literary information service departments of the time. This resulted in the separation of socially focused professional education and scientific research. However, with the advent of digitization and networking, information services in these countries are now in a gradual transition of permeation and fusion, stimulating the development of socially focused information science research (Broadbent 1984). The crossover and integration of various information services, the commercialization of Internet-based information services, internationalization, and the development of an electronic global information network in various countries all served to finally raise the issue of establishing a theoretical system and developing professional education and training in all areas of information science, according to the general development model of information management systems (Martin 1999).

Specialized education in information science began later in China than in developed countries. However, the more modern information and technological environment enabled the development of specialized education to bypass the long-term separation of library and information science from economic information management. This integration first revealed itself in undergraduate education reform. In 1998, the Chinese Ministry of Education incorporated into an "infor-

mation management and systems" specialty the scientific and technological information specialties (students before 1998 would have been be in the science department) and the information science, management information system, business administration, and finance related specialties (whose students would have been enrolled in the arts department). This transformation reveals the fusion of information science specialties during their development and the trend toward organizing professional education according to major subject categories.

This integration of undergraduate education not only laid a new foundation for high-level postgraduate education and extended the scope of training, it also created the need to enhance the educational content. In China's case, master's and doctoral courses in information science under the management science department correspond with information management and systems at the undergraduate level. This signifies that the postgraduate specialization of information science will inevitably base its professional training models and systems on various human resource demands to conform with the need for high-level specialized personnel in the digital age.

The principal ingredient in establishing postgraduate training models and systems is the selection and orientation of training objectives. To act in accordance with the requirements of social development and to follow the objective rules in personnel training, we should plan our postgraduate education models in information science according to master's and doctoral levels. The objective is to have students master the basic theory of information science, as well as practical systematic professional aspects and scientific research methods, so that they will be equipped to undertake scientific research and creative work in the fields of information science and information management. This objective emphasizes both specialization and expertise in basic theory, as well as competence in all aspects of information management business in the digital age. In other words, it emphasizes the production of high-level creative individuals who are competent both generally and in their specialized field.

In the digital age, information science professionals must not only be prepared for real occupations, but also adjust to the new social, informational, technological, and cultural environments to meet new challenges creatively (Hu 1999). Therefore, the objectives of graduate training should depend on the needs of various countries' education systems for research personnel. Master's education should be based on the training of resourceful applied personnel. The education of doctoral students should emphasize developing creative research personnel. In organizing such degrees, course teaching and research guidance should be combined to form an objective-oriented education system.

2. The Deepening of Content and Expansion of Systems in Information Science Graduate Degree Courses

In an increasingly information-oriented environment, postgraduate education in information science is changing from the old specialized organizational model to a more open socially oriented model. Degree courses established according to different professional specializations are becoming increasingly difficult to adapt to training the specialized qualified personnel required in today's society. In light of this, a broad-based, high-level personnel-training system is currently being formed. With regard to the organization of course content (apart from formulating specific objectives and optimizing management), the main ideas that have been essential to the development of creative applied research personnel are to combine basic theory with expertise, to coordinate technical applications and research, and to give full consideration to both specialized research papers and theory-based courses. The main challenges are to augment course content and to continually expand the systems.

The profound changes in the information and technological environments reflect the rapid developments in science and technology, the expanding economy, and the rapid growth of the knowledge economy. The development of science and economy in turn reflects the socialization of social organizational mechanisms and functional modes. This transformation requires us to change the traditional methods of information science education, and, while expanding the sphere of its applied research, enhance the content of specialized education and update course content in new growth areas. The specific requirements are to transform the course structure that is based on the detailed procedures of doing a job into a degree course structure and system that is based on information science with information management technology and management research at its core. This change in the course structure requires augmenting the core curriculum content in the areas of applied technology and management research, and expanding the students' knowledge in their training.

1. Enhance the basic theory curriculum. In the digital age, the evidence of informational mechanisms, patterns of societal information flows, and the establishment of an elementary investigative information science theory dealing with informational phenomena in society are essential to enhancing the course content of basic information science theory. The main content of basic information science theory should include the principles of information management, methods of information organization and information resource management, information services and their management, information economy theory, and other fundamental concepts. The course structure should emphasize the transformation from organizing teaching and course content based on the elements of information collection, exchange, organization, processing, and provision of services to a systematically arranged course structure designed according to information

flow patterns and informational mechanisms in society. This will enhance the course content so that it can be perfected on the basis of a unified course outline.

2. *Raise the technological point of departure of courses in the teaching of application technologies.* Information science is a highly applied discipline, so in training high-level personnel, emphasis must be given to the teaching of current information technology. This necessitates the regular updating of course content. At present, the development of computerized information processing technology, communications technology, and network technology is not only transforming the structure of information organization and services, it is also transforming the methods employed in information organization and services. Therefore, applied technology courses should not only include current information technology applications, but also technological innovations in the areas of information organization and services in order to meet the demands of the digital age for information science postgraduates with practical experience and creative technical abilities.

3. *Regularly update course content during the practice of teaching in management research.* The development of modern management and management science has presented information science with a series of new subjects that need our extensive research. The subjects include organizational mechanisms of information management, asymmetry of information in decision-making, and sequentialization of information based on knowledge management. The appearance of these problems necessitates the enrichment of course structures. The systemization and innovation of management theory serve as a major premise for the enrichment of course structures. It therefore follows that information science postgraduate degree courses must emphasize the application of modern management theory and that course content must be enriched and augmented according to the needs of modern management. As a branch of management science, high-level education in information science should fully reflect the newest achievements in management science in order to resolve underlying problems relating to information management in modern management practice.

4. *Expand the scope of courses.* The digital age demands that the knowledge and skills of information science graduates be comprehensive; for example, high-level information managers in modern enterprises should not only possess information organization abilities adapted to modern technologies, but also integrated management abilities and the capability for innovation in information science. Therefore, in postgraduate training course structures and systems, there should be an emphasis on the influence of the crossover and synthesis of subjects. Course systems should be designed on the basis of the models of development of specialization-oriented technology and the integration of specialization and synthesis. On the other hand, the development of course systems must also be based on the merging and restructuring of undergraduate courses, and on postgraduate education integrating various areas of educational content for applied research personnel.

3. Instructional Organization in Enhancing and Expanding Information Science Postgraduate Courses

The enhancement and expansion of information science postgraduate courses is a systematic reform in response to the digital age. In instructional organization, an emphasis should be placed on the coordination of elements in "goal-oriented" course teaching and optimization of teaching methods. According to this principle, the following aspects of work should be considered:

1. *Combine teaching with training in how to innovate.* One of the objectives of postgraduate courses is to transfer knowledge and reinforce the students' knowledge base to ensure that the instructional framework conforms to a knowledge structure to keep pace with developments in the field and societal needs. However, the accelerating pace of identifying new knowledge in the digital age, especially the boom in information technology, has seen the standard "knowledge transfer" model come under attack. In information science postgraduate education, the transfer of knowledge should be seen as a basis for innovation. Postgraduate education, in addition to transferring indispensable knowledge, should foster graduates' ability for knowledge acquisition and their ability to innovate.

There is an intrinsic relationship between knowledge structure and the ability to innovate within this structure. Consequently, in the organization of teaching, the amount of time spent on classroom teaching, examination, and discussion of special topics and extracurricular research should depend on the different content of foundation courses, technology courses, and management research courses according to different categories of knowledge. To optimize results, the objectives of each teaching element should be analyzed according to the overall objective.

2. *Combine course teaching with course practice.* Information science courses are highly practical in nature. If course study were not combined with corresponding social practice, it would be difficult for the course to meet the training objectives of knowledge acquisition and the ability to innovate. The content and direction of practical work should vary in view of the plurality of directions for information science postgraduate work (i.e., flexibility in the directions for research of various aspects in society) and the various requirements and characteristics of basic theory, technology, and course management.

At present, those courses teaching basic theory focus on case analysis and systematic investigation. Technology-focused courses stress practical operation of technology and the transformation into processes. Management courses fo-

cus on in-depth social practice and course content develops around management services. In the arrangement of practical courses, fundamental knowledge, technology, and management courses should be given comprehensive consideration and be carried out in accordance with overall objectives.

3. Combine course teaching with research innovations. The priority in developing good postgraduates should be to foster students' ability to innovate in research and to develop their fundamental skills. Course teaching is the most essential element in this process. As innovation in research is an acquired skill, innovation in information science research can be made a basic requirement within the teaching of technology and management courses, using practical work as a foundation. Innovations in research should be combined with work on special projects carried out to complement the course teaching and practical work. This will optimize the selection of subjects for postgraduate degree theses and enhance the thesis research.

In developing postgraduates' "innovation in research," attention should be paid to the appropriateness of topic selection. That is, research for courses in innovation should be organized according to the curriculum and synthesized course plan so that it conforms to instructional requirements and so that the assessment of such courses can be incorporated into the teaching systems of the entire curriculum.

4. Establish a comprehensive system for the evaluation and assessment of teaching quality. Evaluating the teaching quality in postgraduate courses is the last element in the organization of degree course teaching. Assessment can be carried out from two angles combining the reforms that have taken place in the digital age. First, both teachers and students alike should carry out evaluations within learning institutions. The scope of the inspection should include the organization of lesson content, structure of teaching components, the execution of academic programs, and all targets that reflect the enhancement and expansion of the course content. Second, periodic extracurricular inspection should be carried out that would include examination of the teaching practice and structure, their effects according to the arrangements of various courses, and a synthesized assessment and subsequent optimization based on the course objectives.

The enhancement and expansion of information science postgraduate degree courses in the digital age and the reform of course teaching is a complex systematic project that is certain to be fully implemented in educational practice.

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Appendix A

Institutions Represented at the Conference

Anhui University Management School
Chinese Academy of Science Documentation and Information Center
Chinese Technology and Information Institute
Dongbei Normal University Information Management College
Hebei University Information Management Department
Heilongjiang University Information Management Department
Huadong Normal University Information Studies Department
Huazhong University of Science and Technology Information Management Department
Huazhong Normal University Information Management Department
Jilin University Information Management Department
Nanjing University Information Management Department
Nanjing Agricultural University Information Department
Nankai University International Business School Information and Industrial Studies Department
National Engineering and Technology Library
National Library of China
Peking University Information Management Department
Pittsburgh University Library and School of Information Science
San Jose State University School of Library and Information Science
Shanghai University Information Management Department
Sichuan University Information and Archives Department
Tongji Medical University Information Management Department
University of Arizona School of Information Resources and Library Science
University of California at Berkeley Library
University of Illinois, Champaign-Urbana Graduate School of Library and Information Science
Wuhan University School of Mass Communication and Information
Xi'nan Normal University Computer and Information Science College
Xiangtan University Management School Information Management Department
Zhengzhou University Information Management Department
Zhengzhou Aviation College Management School
Zhengzhou Aviation College Information Management Department
Zhongshan University Information Management Department

Appendix B
Symposium Agenda

Sino-US Symposium on Library and Information Science Education in the Digital Age

Agenda

Monday, November 6

Morning

Welcoming remarks

Plenary Session I: Embedding an LIS School within the University and Society

Keynote speaker: Leigh Estabrook, dean and professor, Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign

Commentator: Chen Chuanfu, professor and vice dean, School of Mass Communication and Information Management, Wuhan University

Plenary Session II: Information Science Facing the 21st Century

Keynote speaker: Liang Zhanping, professor and director, Institute of Scientific and Technical Information of China

Commentator: Chen Chuanfu, professor and vice dean, School of Mass Communication and Information Management, Wuhan University

Afternoon

Plenary Session III: Influences of the Digital Library on the Needs of Library Science Specialists

Keynote speaker: Sun Beixin, associate director, National Library of China*

* did not submit a formal paper for the symposium

Appendix B (contd.)

Plenary Session IV: Educating Library Management Personnel in the Digital Age

Keynote Speaker: Charles Yen, university librarian, University of Macau'

Plenary Session V: Influences of Digital Technology on Library and Information Science Education

Keynote speaker: Wang Shiwei, director, Shanghai Library'

Commentator: Cheng Huanwen, professor and chief librarian, Zhongshan University Library

Tuesday, November 7

Morning

Plenary Session I: The Role of the Dean in Implementing Change

Keynote speaker: Brooke Sheldon, professor emeritus and former dean, Graduate School of Library and Information Science, University of Texas at Austin

Commentator: Ke Ping, chief librarian, Zhengzhou University Library, and professor and director of information management, Zhengzhou University

Plenary Session II: Again on the Development of our Discipline: Suggesting "Information Resources Management" be our First-level Discipline

Keynote speaker: Meng Guangjun, research librarian, Document and Information Center, Chinese Academy of Sciences

Commentator: Ke Ping, chief librarian, Zhengzhou University Library, and professor and director of information management, Zhengzhou University

Plenary Session III: The Reformation and Innovation of Library Science Education in the Digital Age

Keynote speaker: Peng Feizhang, professor, School of Mass Communication and Information Management, Wuhan University

Commentator: Zhan Deyou, professor and former director, Department of Library Science, School of Mass Communication and Information Management, Wuhan University

Plenary Session IV: The Current Situation of Education in Library and Information Science Education in China

Keynote speaker: Wu Weici, professor, School of Information Management, Peking University

Commentator: Zhan Deyou, professor and former director, Department of Library Science, School of Mass Communication and Information Management, Wuhan University

Afternoon

Parallel small-group sessions:

1. Challenges and Trends of Education in Library and Information Sciences in the Digital Age
2. Curriculum Teachers and Teaching Methods of Library and Information Sciences in the Digital Age

Appendix B (contd.)

3. The Qualities of Graduates and Core Courses in Library and Information Sciences in the Digital Age

4. Graduate Education in Library and Information Sciences in the Digital Age

Wednesday, November 8

Morning

Plenary Session I: The Transformation of Academic Libraries in the 21st Century: Challenges and Opportunities for Library and Information Science Education

Keynote speaker: Rush Miller, director and librarian of the University Library System, professor in the School of Information Sciences, University of Pittsburgh

Commentator: Dong Hui, professor and former director, Department of Information Management, School of Communication and Information Science, Wuhan University

Plenary Session II: Educational Goals and their Achievement in Library and Information Sciences in the Digital Age

Keynote speaker: Ma Feicheng, professor and dean, School of Mass Communication and Information Management, Wuhan University

Commentator: Dong Hui, professor and former director, Department of Information Management, School of Communication and Information Science, Wuhan University

Reports from Parallel Sessions

Afternoon: Visit other university libraries

Thursday, November 9

Morning

Plenary Session I: New Developments in Graduate Education in Library and Information Science in the US: Formats and Technologies for Offering Distance Education Courseware

Keynote speaker: Blanche Woolls, professor and director, School of Library and Information Science, San Jose State University

Commentator: Zhao Yangling, associate research librarian, Institute of Scientific and Technical Information of China

Plenary Session II: Some Reflections on Library Education in China

Keynote speaker: Peter Zhou, director, East Asian Library, University of California at Berkeley

Commentator: Zhao Yangling, Hebei University Information Management Department

Appendix B (contd.)

Pleanary Session III: A Comparative Analysis of LIS Graduate Education in China and the United States

Keynote speaker: Chen Chuanfu, professor and vice dean, School of Mass Communication and Information Management, Wuhan University

Commentator: Wang Shiwei, director, Shanghai Library

Plenary Session IV: The Enhancement and Expansion of Information Science Graduate Degree Courses in the Digital Age

Keynote speaker: Hu Changping, professor and vice dean, School of Mass Communication and Information Management, Wuhan University

Commentator: Wang Shiwei, director, Shanghai Library

Afternoon

Celebration of 80th anniversary of Boone Library School

Friday, November 10

Morning

Roundtable meeting of the Deans

Summary of the symposium

Closing ceremony

Appendix C

面向21世纪中国图书情报教育发展行动计划建议
Action Plans Proposal on the Library and Information Science Education in China in the Twenty-first Century

首届中美数字时代图书馆与情报学教育发展研讨会会议成果之一

2000年11月6-10日，经国家教育部批准，武汉大学主办了"数字时代图书馆与情报学教育发展研讨会暨高级研讨班"。来自中国和美国主要图书情报学院的30多名院长和系主任，以及中国国家图书馆、中国科学院文献情报中心、中国科技信息研究所、国家工程与技术图书馆等数十所信息机构的主要负责人和专家学者参加了这次会议。教育部高教司和社政司领导也应邀莅临指导会议。与会专家、学者认真讨论了图书情报学教育在数字时代所肩负的历史使命，就21世纪中国图书情报学专业发展等问题进行了广泛、深入地交流和探讨，达成了关于数字时代图书情报学教育发展战略问题的若干共识。

From November 6 to November 10, 2000, Wuhan University held "the First Sino-U.S. Symposium/Workshop on Library and Information Science Education in the Digital Age," with the approval by the Ministry of Education of the People's Republic of China. Over 30 deans and chairs from Library and Information Science Schools/Departments in China and United States attended this symposium/workshop. In addition, directors, scholars and experts from the National Library of China, the Information Center of the Chinese Academy of Sciences, the Chinese Institute of Scientific & Technology Information, the National Library of Engineering and Technology, and many other information centers in China also attended this symposium/workshop. The officers from the Ministry of Education of the People's Republic of China was also invited to attend for instruction. All the experts and scholars discussed the historical missions of library and information science education in the digital age, explored extensively and in great depth the issues related to the development of library and information science education in China, and reached the following

consensus.

1 使命与目标 Missions and Objectives

适应数字时代的需要，为培养合格的图书馆和信息管理领域的高级复合型专业人才，这种专业人才应具备系统的图书情报学基础理论知识，能够熟练地运用现代信息技术手段从事知识信息的采集、组织、传播、开发、管理与利用，适应全球网络化、数字化信息环境需要，胜任各类信息管理和信息服务工作。

To train qualified library and information management professionals with advanced and comprehensive skills. Those professionals should possess the basic and systematic theories of library and information science, are able to use modern information technologies in a skilful manner to gather, organize, disseminate, develop, manage and use knowledge and information. They should be able to work in all types of information management and services in the environment of global informationization of society.

2 能力与课程设置 Curricula

高等图书情报学教育主要培养学士、硕士、博士层次的专业人才。这些专业人才应具备下述能力：

（1）知识与信息的获取、组织、加工能力；

（2）知识信息的检索、挖掘与提供的能力；

（3）信息系统的涉及与开发能力；

（4）图书馆、情报及各类信息机构的组织管理能力；

（5）信息咨询与服务能力等等。

Advanced library and information science education should focus on the training of LIS bachelor, master and doctorate students for profession. This action plan focuses on the curriculum design for the bachelor and master's programs.

为了获得上述能力，拟设置下述课程（重点是学士与硕士层次）课程结构分为三组：The curriculum consists of three parts:

第一组：通识课程或公共必修课，如外语、哲学等。这组课程是高等教育专业都必须学习的，目的是为继续学习和综合素质奠定基础。

Part One: General courses or compulsory courses shared by other disciplines.

第二组：专业基础课。这组课程是进行专业学习的基础，也是学生获得专业核心能力的基础涉及图书馆学情报学基本理论、计算机原理，程序设计语言，离散数学、数据结构，数据库系统等知识。

Part Two: Basic courses for the LIS majors: This set of courses form the basis of LIS education, as well as the basis for developing the core competencies of LIS majors, concerning foundation of to LIS, principles of computer science, programming languages, discrete mathematics, database structure, database system, etc.

第三组：专业课程。这组课程体现专业的特色和专业的核心能力，是本专业区别于其他专业的标志涉及信息组织、信息检索、信息分析与预测、图书馆组织与管理、信息服务与用户研究，信息资源管理、因特网信息资源组织与利用、信息经济学、文献计量学、信息系统开发与管理、网页制作与网站设计等等知识。

Part Three: Courses for LIS majors: This set of courses reflect the special characteristics of LIS majors and core competencies, and distinguish one LIS major from another. They concern *organization of information, information retrieval, information analysis and prediction, library management, information service and user studies, information resource management, organization and use of Internet resources, information economy, information statistics, the development and management of information systems, homepage design and construction, etc.*

3 行动计划 Action Planning

为了适应数字时代 LIS 事业发展的需求，我们认为必须从学科、专业和事业发展的长远利益出发，积极主动地强化图书情报学教育，为此提出以下行动方案建议：

In order to meet the demands of LIS development in the digital age, we believe we must further develop and enhance LIS education to ensure its

Appendix C (contd.)

long-term development. Therefore, we propose the following action plans:

3.1 成立全国性的图书馆学和情报学教育专业教学指导委员会

Establish the National Council on LIS Education

3.2 成立有国内外各LIS领域专家参与的图书情报学教育咨询委员会

Establish an LIS advisory committee composed of scholars in China and abroad who are experts in this field

3.3 在全国范围内实施LIS从业人员专业资格证书制度

Establish a national certification system for library and information professionals

3.4 加强图书情报学教育师资特别是中青年师资队伍建设，加强图书情报学教育师资的IT培训工作

Enhance LIS faculty especially middle-young aged faculty and their IT training

3.5 促进图书情报学教育资源的流动与共享

Promote LIS education resource sharing and distribution

3.6 加强图书情报学教育研究工作，拓展和深化图书情报学教育研究

Enhance, expand and deepen LIS research

3.7 设立LIS专业硕士学位，扩大LIS研究生教育，逐步缩小本科教育规模

Establish more LIS masters programs to increase the proportion of graduate LIS education, and gradually reduce LIS undergraduate education

3.8 加强图书情报学教育机构之间以及图书情报学教育机构与其他机构之间的合作关系

Enhance the cooperative relations between LIS educational institutions and other institutions

3.9 使图书情报学教育的目标和重点与其所在大学的目标和重点等保持一致

Ensure that the missions and priorities of the LIS program are aligned with missions and priorities of its parent university

3.10 发展图书情报学教育远程教育，推进图书情报学教育普及教育

Develop distance education in LIS so as to promote the popularization of LIS education

Appendix C (contd.)

3.11 设立图书情报学教育师资奖励和培训基金和制度

Establish award and training funds for LIS faculty

3.12 重视树立图书情报学教育的品牌形象

Establish the positive image/reputation of LIS education

出席会议主要单位（按拼音字顺排列）：

出席会议主要单位（按拼音字顺排列）：

安徽大学管理学院
北京大学信息管理系
东北师范大学信息管理学院
国家工程与技术图书馆
河北大学信息管理系
黑龙江大学信息管理系
华东师范大学信息学系
华中科技大学信息管理系
华中师范大学信息管理系
吉林大学信息管理系
南京大学信息管理系
南京农业大学信息系
南开大学国际商学院信息产业学系
上海大学信息管理学系
四川大学信息与档案学系
同济医科大学信息管理系
武汉大学传播与信息学院
西南师范大学计算机与信息科学学院
湘潭大学管理学院信息管理系
郑州大学信息管理学系
郑州航空学院管理学院
郑州航空学院信息管理学系
中国国家图书馆
中国科技信息研究所
中国科学院文献情报中心
中山大学信息管理学系
美国伯克里加州大学图书馆
美国依利诺大学图书馆学情报学研究生院院长
美国德克萨斯大学奥斯汀分校图书情报学院
美国圣何塞州立大学图书情报学院院长
美国匹兹堡大学图书馆

Appendix C (contd.)

美国匹兹堡大学信息科学学院
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